WATER & WASTEWATER UTILITY SPECIFICATIONS AND DOCUMENTATION REQUIREMENTS

TOWN OF HILLIARD, FLORIDA

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MANUAL OF STANDARDS AND SPECIFICATIONS FOR UTILITIES CONSTRUCTION

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INTRODUCTION

DOCUMENT TITLE

The title of this document is "Manual of Standards and Specifications for Utilities Construction, Town of Hilliard (“TOWN”), Florida." Other Town of Hilliard documents that supplement this document include the Town of Hilliard Code of Ordinances.

JURISDICTION

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

Private facilities connecting to the TOWN’s infrastructure will require review to ensure proposed infrastructure meets minimum requirements and minimizes potential for infiltration and inflow to the sewer system as well as limits water loss in the water system(s).

PURPOSE

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

SCOPE

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

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

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

This document applies to facilities constructed by private entities that will be conveyed to the TOWN for final ownership, maintenance, and operation. These standards and specifications do not apply to private developments such as, but not limited to: apartment complexes, condominium developments, and/or other developments that operate under a common ownership where private members pay rent to live within a development. These locations shall be coordinated with TOWN on an individual basis where the TOWN will provide bulk water through a master meter with backflow preventor assembly and/or accept bulk wastewater from one or more private pump stations. The TOWN’s ownership of improvements will be coordinated with the individual developer and will extend no further than existing public rights of way and/or utility easement locations specifically agreed to by the TOWN and developer.

PART 1 - STANDARDS

DIVISION I
GENERAL REQUIREMENTS

SECTION 10

DEFINITIONS

10.1 DEFINITIONS

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

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

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

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

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

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

TOWN - means the Town of Hilliard Commissioners and/or its designated representative(s).

TOWN ENGINEER - Town's designated Town Engineer.

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

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

DIPRA - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Director of Public Works of the Town of Hilliard, Florida, acting directly or through an assistant or other representative authorized by him.

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

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

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

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

MANUAL - means this the Town of Hilliard Manual of Standards and Specifications for Utilities Construction.

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

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

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

OSHA - means the Federal Occupational Safety and Health Administration.

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

PLANS - means DRAWINGS as defined herein above.

PUBLIC WORKS - means the Public Works Department of the Town of Hilliard, Florida.

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

SITE DEVELOPMENT ORDINANCE - means the Town of Hilliard Site Development Ordinance, including latest amendments.

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

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

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

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

SUBDIVISION REGULATIONS - means the Town of Hilliard Subdivision Regulations, latest edition.

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

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

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

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

SECTION 11

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

11.1 PLANS AND SPECIFICATIONS

11.1.1 GENERAL

All submitted plans shall be standard size sheet (24" x 36", 22" x 34", or 11" x 17") with title block. Graphic scale(s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. Submittal of specifications will only be required when special facilities outside the scope of this MANUAL are proposed. All PLANS sheets and the title page of submitted specifications must be signed, sealed and dated by the DEVELOPER's ENGINEER.

11.1.2 MASTER PLAN

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

11.1.3 PLAN AND PROFILE

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

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

1. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.

2. Profile with elevations at 100 foot interval, or more frequently if required by good design practice.

3. Development layout with horizontal and vertical controls.

4. All conflicts with other utility and drainage systems.

5. All manhole locations and rim elevations for manholes outside of paved areas.

6. Pipe data including size, lengths, material, and slopes.

7. Size, type, and locations of fittings, valves, hydrants, air release/vacuum release, and other related appurtenances.

8. Limits of pipe deflection.

9. Limits of special exterior coatings.

10. Limits of special bedding requirements.

11. Pipe restraint requirements.

12. Details of connection to existing systems.

13. Location(s) and general layout of wastewater pumping stations.

14. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.

11.1.4 DETAILS

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

11.1.5 SCALE

The master plan shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 30'. Special details shall be of sufficiently large scale to show pertinent construction information.

11.2 SUBDIVISION RELATED WATER, WASTEWATER AND RECLAIMED WATER IMPROVEMENTS

11.2.1 GENERAL

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

11.2.2 DESIGN AND PLAN REVIEW

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

11.2.3 CONSTRUCTION INSPECTION

The DIRECTOR or his designated representative shall inspect the water, wastewater and reclaimed water improvements to ensure their compliance with requirements in Divisions II, III, IV and V of this MANUAL.

11.2.4 APPROVAL AND ACCEPTANCE

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

11.3 WATER, WASTEWATER AND RECLAIMED WATER SYSTEM IMPROVEMENTS ASSOCIATED WITH THE TOWN OF HILLIARD SITE DEVELOPMENT ORDINANCE

11.3.1 GENERAL

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

11.3.2 DESIGN AND PLAN REVIEW

Design of water, wastewater and reclaimed water system improvements shall be in compliance with the design standards in Division II and the specifications outlined in Divisions III, IV and V of this MANUAL. PLANS will be reviewed and approved by the TOWN's Engineer as part of the Commercial Site Plan review process.

11.3.3 CONSTRUCTION INSPECTION

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

After all required improvements have been installed, the DESIGN ENGINEER shall submit certification to the TOWN that the improvements have been constructed substantially according to approved plans and specifications. Non-compliance with approved plans or specifications or evidence of faulty materials or workmanship shall be called to the attention of the CONTRACTOR or DEVELOPER's DESIGN ENGINEER and, if not corrected in an expeditious manner, all work on the project will be suspended and/or certificate of occupancy withheld. Laboratory tests may be required when appropriate.

11.3.4 MAINTENANCE, MATERIALS AND WORKMANSHIP WARRANTY BOND

A bond shall be posted by the DEVELOPER or CONTRACTOR and executed by a company authorized to do business in the State of Florida that is satisfactory to the TOWN, payable to the Town of Hilliard in the amount of twenty (20) percent of the estimated construction cost of all required water, wastewater and reclaimed water system improvements to be owned and maintained by the TOWN. Such bond shall guarantee maintenance of all improvements intended to be owned and maintained by the TOWN for a two (2) year period, and the materials, workmanship and structural integrity of utility systems, and miscellaneous related facilities, excluding mechanical equipment for a two (2) year period, commencing after a Certificate of Completion has been issued by the TOWN. The manufacturer's warranty will be acceptable for mechanical equipment. As an alternative to the provision of a surety bond, the, DEVELOPER/CONTRACTOR may provide for the deposit of cash in an escrow account or a letter of credit acceptable to the TOWN.

11.3.5 CERTIFICATE OF COMPLETION/APPROVAL FOR MAINTENANCE

After successful completion of all water, wastewater, and reclaimed water system improvements, and after receipt of the required documents. The TOWN will provide a "Certificate of Completion" verifying the satisfactory construction of all improvements intended to be owned and maintained by the TOWN. After the two (2) year Warranty Period and verification by the TOWN of satisfactory performance of all water, wastewater, and reclaimed water system improvements, the TOWN will issue the "Approval for Maintenance", thereby releasing the DEVELOPER or CONTRACTOR from further responsibilities.

11.4 MISCELLANEOUS WATER, WASTEWATER AND RECLAIMED WATER SYSTEM IMPROVEMENTS

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

11.5 COMPLIANCE WITH OTHER REGULATORY REQUIREMENTS

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

11.6 RECORD DRAWINGS

The DESIGN ENGINEER shall submit two (2) certified sets of Record Drawings to the TOWN prior to issuance of Certificate of Completion for the improvements. The DESIGN ENGINEER shall be responsible for recording information on the approved PLANS concurrently with construction progress. Record Drawings submitted to the TOWN as part of the project acceptance shall comply with the following requirements:

1. Drawings shall be legibly marked to record actual construction.

2. Drawings shall show actual location of all underground and above ground water, wastewater and reclaimed water piping and 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 lengths and diameters of mains, actual installed pipe material, class, etc.

3. Global Positioning System (GPS) coordinates included as follows:

Potable Water and Fire Mains

a. The location of all valves, fittings, fire hydrants, water meter boxes, casings and points of connection to the existing system shall be referenced by coordinates.

b. The positional accuracy relative to the referenced published control points used shall not exceed 0.5' horizontally and 0.1' vertically. Elevations relative to the site facilities must be within 0.1' of each other.

c. Coordinates or elevations on the main and finished grade will also be required at all pipe dead-ends, intersections, size changes, points of connection to existing system, fittings (bends, valves, tees, plugs, etc.), at intersections of pipe, at 100' intervals, or to the nearest fitting/structure, whichever is less, and where the standard depth of cover is not provided.

Gravity Wastewater

a. The location of all piping, wyes, tees, manholes, cleanouts, and points of connection to the existing system shall be referenced by coordinates.

b. The positional accuracy relative to the referenced published control points used shall not exceed 0.5' horizontally and 0.1' vertically. Elevations relative to the site facilities must be within 0.1' of each other.

c. Runs of gravity wastewaters shall be identified (i.e., 300' of 8" PVC SDR26 at S = .004).

d. Elevations shall be given for the north rim of the top of all manhole covers and all manhole inverts.

e. Elevations on the service piping and finished grade will be required at the property line for only those wastewater service laterals which result in more than 60 inches of cover or less than 30 inches of cover (these exceptions must be TOWN approved.

f. For wastewater service laterals which are totally perpendicular to the main, the location of the end of wastewater services shall be given to the plug and be located from the side property line or by station and offset. For wastewater service laterals, which include bends and off-sets which result in a service which is not totally perpendicular to the main, the location of all fittings between the sanitary tee and the plug (at the property line) shall be provided.

g. Manhole types shall be identified (i.e., Type “A”, “B”, etc.)
   1) Identify Exterior joint tape type used at the manhole joints.
   2) List manhole manufacturer name.

Force Mains

a. The location of valves, fittings, casings, and points of connection to the existing system shall be referenced by coordinates.

b. The positional accuracy relative to the referenced published control points used shall not exceed 0.5’ horizontally and 0.01' vertically. Elevations relative to the site facilities must be within 0.1of each other.

c. Coordinates or elevations on the main and finished grade will be required at points of connection to the existing system, fittings (bends, valves, tees, plugs, etc.), 100' intervals, at high points, and where the standard depth of cover is not provided.

Pumping Stations

a. Wetwell size and location shall be indicated and located relative to property lines and/or right-of-way lines.

b. All utilities within the pump station site shall be located relative to property lines and/or right-of-way lines.

c. Elevations shall be indicated at inverts, wetwell top (rim elevation) and invert, and at ground adjacent to wetwell. All utilities materials and sizes of lines and fittings shall be indicated.

d. All schedules that show pump, motor, and electrical data shall be corrected to show the as-built condition and submitted with the pump station drawings.

e. As-built information should be provided for the pump station site plan. Within the pump station boundaries, the following shall be located horizontally: pump-out, water service and cross-connection control device, wetwell, control panel, bends, fittings, manholes, generator and fuel tank (if applicable), transformer, fence, and auxiliary electrical enclosures, as applicable.

Reclaimed Water

a. The location of valves, fittings, water meter boxes, casings, and points of connection to the existing system shall be referenced by coordinates.

b. The positional accuracy relative to the referenced published control points used shall not exceed 0.5’ horizontally and 0.1' vertically. Elevations relative to the site facilities must be within 0.1' of each other.

c. Coordinates or elevations on the main and finished grade will be required at points of connection to the existing system, fittings (bends, valves, tees, plugs, etc.), 100' intervals, at high points, and where the standard depth of cover is not provided.

Storm Drain

a. The location of all piping, wyes, tees, manholes, inlets, cleanouts, and points of connection to the existing system shall be referenced by coordinates.

b. The positional accuracy relative to the referenced published control points used shall not exceed 0.5’ horizontally and 0.1' vertically. Elevations relative to the site facilities must be within 0.1' of each other.

c. Runs of storm wastewaters shall be identified (i.e., 300' of 15" RCP at S = .004).

d. Elevations shall be given for the north rim of the top of all manhole covers and inlets and catch basins and all manhole, inlet, and catch basin inverts.

e. Storm drain, manhole, inlet, and catch basin types shall be identified.

Horizontal Directional Drill (HDD)

a. The beginning and ending points of the HDD main shall be provided by a registered Professional Surveyor and Mapper. The HDD contractor shall provide an approved certified as-built drawing, directional bore log plan and profile on a 24" x 36" or 22" x 34" sheet and AutoCAD file (certified by the HDD contractor) of the HDD work indicating horizontal and vertical location data (continuous or data every 25 LF of main). A copy of the bore log shall be placed on the correct “As-Built” sheet where drills are performed. An electronic PDF file containing this same information shall also be provided.

4. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.

5. 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.

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

7. Each sheet of the PLANS shall be signed, sealed and dated by the DESIGN ENGINEER as being "Record Drawings". Construction PLANS simply stamped "As-Builts" or "Record Drawings" and lacking in above requirements will not be accepted, and will be returned to the DESIGN ENGINEER. The "Certificate of Completion" will not be issued until correct "Record Drawings" have been submitted.

8. Two (2) electronic files of record drawings shall be provided to the TOWN. One Drawing file shall be PDF format and the second shall be in AutoCAD format.

11.7 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 TOWN to review and update Appendix A as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this MANUAL. For this purpose, the TOWN shall evaluate technical submittals from interested manufacturers or suppliers at least once every three years.

DIVISION II
DESIGN STANDARDS

SECTION 20

GRAVITY SEWERS

20.1 GENERAL CONSIDERATIONS

20.1.1 TYPE OF SEWERS

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

20.1.2 DESIGN PERIOD

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

20.1.3 LOCATION

Gravity sewers required to serve customers within county or state right-of-way shall be placed within the right-of-way or utility easements. Alternative locations may be approved at the TOWN's sole discretion.

Gravity sewers within TOWN right-of-way or private streets shall be located in dedicated rights-of-way or utility easements under pavement. All sewers located outside of dedicated rights-of-way shall require a minimum 30-foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a gravity sewer is located adjacent to a road right-of-way, a minimum 10-foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. No gravity sewers shall be placed under retention ponds or structures. In general, gravity sewers shall not be located along side or rear lot lines. Placement of a gravity sewer alongside 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.

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

20.2 DESIGN BASIS

20.2.1 AVERAGE DAILY FLOW

The gravity sewer design shall be based on full ultimate development as known, or projected. Average daily wastewater flow shall be calculated by the Equivalent Residential Unit (ERU) method.

20.2.2 PEAK DESIGN FLOW

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

Flow Range	Minimum Peak Factor
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

20.2.3 DESIGN CALCULATIONS

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

20.3 DETAILS OF DESIGN AND CONSTRUCTION

20.3.1 MINIMUM SIZE

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

20.3.2 MINIMUM COVER

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

20.3.3 SLOPE

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

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

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

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

Sewers shall be laid with uniform slope between manholes.

20.3.4 SIZE AND ALIGNMENTS

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

20.3.5 ADDITIONAL REQUIREMENTS

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

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

1. Total sewer extension length shall be limited to 50 feet.

2. Sewer extension location at the initiating manhole shall be plugged to the satisfaction of the TOWN.

3. Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the PLANS.

4. All such sewer extensions shall be inspected and accepted as part of the future construction phase.

20.4 MANHOLES

20.4.1 LOCATION

Manholes shall be installed at the end of each gravity sewer main; 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 TOWN sewer system by a manhole located at the right-of-way line on the private side.

20.4.2 TYPE

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

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

20.4.3 DIAMETER

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

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

20.4.4 FLOW CHANNEL

The flow channel through manholes shall be made to conform in shape and slope to that of the sewers. Flow direction changes in excess of 90 degrees shall not be included in sewer alignments without special consideration. Benching shall be provided which shall have a minimum slope of 2 inches per foot.

20.4.5 MATERIALS

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

20.4.6 CASTINGS

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

20.4.7 ACCESS

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

20.5 SERVICE CONNECTIONS

20.5.1 GENERAL

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

20.5.2 SIZE AND LENGTH

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 100 feet in length,

20.5.3 SLOPE

Service laterals shall have a minimum slope of 1 percent.

20.5.4 CONNECTION

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

20.6 GREASE TRAPS

20.6.1 GENERAL

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

20.6.2 FAST FOOD RESTAURANTS

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

20.6.3 GENERAL RESTAURANTS

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

20.6.4 24-HOUR RESTAURANTS

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

20.6.5 CONVENTION CENTER/MANUFACTURING CAFETERIAS

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

20.6.6 MISCELLANEOUS FOOD PREPARATION/SERVICE ESTABLISHMENTS

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

20.7 MATERIALS, INSTALLATION, AND TESTING

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

SECTION 21

WASTEWATER FORCE MAINS

21.1 GENERAL CONSIDERATIONS

21.1.1 DESIGN PERIOD

Force main systems shall be designed for the estimated ultimate service population, and (where applicable) as delineated in the TOWN's Wastewater Master Plan (latest edition).

21.1.2 LOCATION

Force main required to serve customers within county or state right-of-way shall be placed within right-of-way or utility easements. Alternative locations may be approved at the TOWN's sole discretion.

Force mains within TOWN right-of-way or private streets 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 10-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 15-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 or structures.

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

21.2 DESIGN BASIS

21.2.1 AVERAGE DAILY FLOW

Provisions of Section 20.2.1 shall apply.

21.2.2 PEAK DESIGN FLOW

Provisions of Section 22.1.1 shall apply.

21.2.3 DESIGN CALCULATIONS

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

21.3 DETAILS OF DESIGN AND CONSTRUCTION

21.3.1 VELOCITY AND DIAMETER

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

21.3.2 DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams formula, the value for "C" shall be 120 for ductile iron pipe and 130 for PVC pipe. "C" values greater than 130 shall not be allowed.

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

21.3.3 DESIGN PRESSURE AND RESTRAINT

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

21.3.4 TERMINATION

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

21.3.5 AIR RELEASE AND VACUUM RELEASE VALVES

Air release valves shall be provided, as necessary, to prevent air from accumulating at high points in the force main. All such valves shall be clearly delineated on the force main profile in the DRAWINGS. The DESIGN ENGINEER shall submit calculations to the TOWN justifying the valve sizing. See additional requirements in Section 42.7.

21.3.6 AERIAL CROSSINGS

STRUCTURAL SUPPORT

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

FLOOD CLEARANCE

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

PIPE MATERIAL AND JOINTS

Flanged joints shall be used. Pipe and flange material shall be ductile iron, minimum class 53. All above ground pipe shall be painted as specified in Section 45.4.4 for aboveground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

VALVES

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

GUARDS

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

PERMITS AND REQUIREMENTS OF OTHER AGENCIES

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

21.3.7 UNDERWATER CROSSINGS

PIPE MATERIAL AND COVER

A minimum cover of five (5) feet shall be provided over the pipe. The pipe material shall meet appropriate AWWA Standards for use in submerged conditions.

VALVES

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

PERMITS

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

21.3.8 VALVES

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

21.4 MATERIALS, INSTALLATION AND TESTING

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

21.5 LOCATION AND IDENTIFICATION

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

21.6 ADDITIONAL REQUIREMENTS

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

SECTION 22

WASTEWATER PUMP STATIONS

22.1 DESIGN BASIS

22.1.1 DESIGN FLOWS

Design flows shall be based upon the total ultimate development flow from all contributory areas to the pump station. The design average daily flow shall be computed as outlined in Section 20.2.1. The design pumping capability of the station shall be based upon the Peak Design Flow which shall be calculated by multiplying the design average flow with the applicable minimum peaking factors as outlined below:

Design Average Daily	Minimum Peaking Factor
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

22.1.2 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.

22.1.3 PUMP AND MOTOR SELECTION

Pump station shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition, a minimum 5 HP motor shall be required. Head capacity curves shall be prepared and submitted to the TOWN along with the pump station plans. Such curves shall be based upon the friction losses outlined in Section 21.3.2 of these specifications. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection and head capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

22.1.4 DESIGN CALCULATIONS

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

22.2 DETAILS OF DESIGN AND CONSTRUCTION

22.2.1 FLOODING

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

22.2.2 ACCESSIBILITY

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. A paved or stabilized access road to the pumping station shall be provided.

22.2.3 BUOYANCY

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

22.2.4 PUMP REQUIREMENTS

Submersible wastewater pump stations shall comply with the requirements spelled out in Section 43. 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 wetwell or disconnecting any piping in the wetwell.

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.

22.2.5 WETWELL REQUIREMENTS

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

Pumping levels shall be set to provide a minimum capacity between operational water levels sufficient to allow a minimum of ten (10) minutes between successive starts of the pumps.

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

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

No interior ladders shall be permitted in the wetwell.

Only one inlet connection shall be permitted to a wetwell.

All wetwells shall have a protective coating.

All hardware materials utilized within the wetwell shall be 316 SS.

22.2.6 PUMP STATION WATER SERVICE

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

22.2.7 ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS

Requirements in Sections 45 shall apply.

22.2.8 CONTROLS

Requirements in Section 45 shall apply.

22.2.9 SITE SIZING AND EASEMENT REQUIREMENTS

Pump station sites shall be sized as delineated on the “Pump Station Site Plan” in the STANDARD DRAWINGS. The DEVELOPER shall dedicate pump station site by warranty deed or plat to the TOWN. 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 TOWN 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.

22.2.10 SITE FENCING

Fencing at the pump station site perimeter shall comply with the technical criteria established in Section 43.10. In general, all pump station sites shall be fenced. However, exception to this requirement may be made for pump stations serving residential areas only, on a case-by-case basis and subject to sufficient landscape screening.

22.3 FLOWMETERS

Indicating, totalizing, and recording flow measurement shall be provided at pumping stations designed to handle peak flows of 1000 gpm or more. Applicable provisions of Section 43.9 shall apply.

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

22.4 EMERGENCY OPERATION

All pump stations shall be provided with emergency power receptacles as specified in Section 43.8. Determination of pump station critical points shall be at the discretion of the TOWN. All pump stations having one (1) of the following characteristics shall be designed to provide emergency power generation by on-site stand-by diesel engine generators.

1. Stations that repump flow from another pump station.

2. Stations that are designed to discharge a peak flow of 1,000 gpm or greater.

3. Stations that are designed with a discharge force main of 12-inches or greater.

4. Stations that require pumps that are 30 horsepower (each) or greater.

5. Stations that require 460 volt electrical power.

6. Stations located within 200 feet of a natural water body or environmentally sensitive area.

7. As determined by the TOWN.

Such stand-by generator facilities shall comply with the requirements included in Section 43.8. All such generators shall be rated and designed to operate the pump station under design conditions.

SECTION 23

WATER MAINS

23.1 GENERAL CONSIDERATIONS

23.1.1 TYPE OF WATER MAINS

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

23.1.2 DESIGN PERIOD

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

23.1.3 LOCATION

Water main required to serve customers within county or state right-of-way shall be placed within utility easements. Alternative locations may be approved at the TOWN's sole discretion.

Water mains within TOWN right-of-way or private streets shall be located in dedicated rights-of-way or utility easements not under concrete sidewalks whenever possible. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 10-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 15-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 or structures.

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

23.2 DESIGN BASIS

23.2.1 AVERAGE DAILY DEMAND AND PEAK DEMAND

Average daily water demand shall be calculated by referencing the Equivalent Residential Connection (ERU) flow rates. Maximum daily and peak hourly water demand rates shall be two times (2x) and four times (4x) the average daily demand, respectively.

23.2.2 FIRE FLOW FOR SUBDIVISIONS AND COMMERCIAL PROPERTY

The approval of fire flow design is for the utility system only and does not address building plan review. Developers are advised to consider proposed

building requirements when designing utility systems, specifically proposed buildings requiring Needed Fire Flow that exceed minimum fire flows provided by the utility system. Sprinkled systems may be required per the Florida Building Code and/or the Authority Having Jurisdiction.

The developer shall provide the basis of design and fire flow requirements for review and approval by the TOWN. Fire flow requirements and calculations shall be supported by the Insurance Services Office (ISO) and National Fire Protection Association (NFPA).

The TOWN's utility system may be limited in the amount of fire flow that can be provided to a specific location in the TOWN'S SERVICE AREA. The Developer may be required to provide capital improvements and/or on-site systems to meet the Needed Fire Flow.

23.2.3 DESIGN CALCULATIONS

DESIGN ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all water distribution projects. Calculation shall show the water mains will have sufficient hydraulic capacity to transport peak hourly flows and the combination of maximum daily flows and fire flows while meeting the requirements of Section 23.2.1. Head losses through meters and backflow devices shall also be included in calculations. Flow in pipelines shall not exceed a velocity of 6 feet per second.

23.3 DETAILS OF DESIGN AND CONSTRUCTION

23.3.1 PRESSURE

All water mains shall be designed in accordance with Section 23.2 above. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high-density residential areas. The normal working pressure in the distribution system should be approximately 55 psi, but in no case less than 35 psi on the downstream side of a meter. For pressures greater than 90 psi, special provisions may be required. Design Friction Losses for water mains shall meet 10 State Standard Requirements.

23.3.2 DIAMETER

Pipe diameters shall be standard sizes. Four (4) inch water mains shall be permitted only in cul-de-sac areas with a maximum length of 500 feet of pipe. In cul-de-sac areas only, a 4-inch looped connection may be allowed to prevent dead ends. As a minimum, 6-inch looped systems shall be required in low density residential projects. In commercial, industrial, and high-density residential areas, minimum 8-inch looped mains shall be required. Larger size mains shall be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified in Section 23.3.1.

23.3.3 FIRE HYDRANT LOCATION, SPACING AND TESTING

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

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

Residential - 500 ft.
Commercial - 500 ft.
Industrial - 300 ft.

Flow tests shall be performed by the DEVELOPER/CONTRACTOR to determine pressure and flow-producing capabilities within the distribution system. The flow tests shall be performed according to the American Water Works Association Manual of Water Supply Practices M17, *"INSTALLATION, FIELD TESTING, AND MAINTENANCE OF HYDRANTS" Third Edition.*

A test report shall be submitted to the TOWN and shall include the following information:

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

23.3.4 DEAD ENDS

In order to provide increased reliability of service and reduce head loss, dead ends shall be prohibited unless approved by the TOWN by making appropriate tie-ins whenever practical, as determined by the TOWN.

Where dead-end mains occur, they shall be provided with a fire hydrant or with an approved hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer.

23.3.5 VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500-foot intervals in commercial, industrial, and high-density residential areas and at not more than 1000-foot intervals in all other areas. Appropriate valving shall also be provided at all areas where

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

23.3.6 SEPARATION OF WATER MAINS AND SEWERS

Refer to FDEP rules for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer manhole.

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

23.3.7 SURFACE WATER CROSSINGS

The TOWN shall be consulted before final PLANS are prepared. Requirements outlined in Section 11. All above ground pipe shall be epoxy-coated.

23.3.8 AIR RELEASE VALVES

At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or automatic air release valves. Automatic air release valves shall not be used in situations where flooding of the manhole or chamber may occur. See details in Section 50, Appendix A, and Appendix C - STANDARD DRAWINGS.

23.3.9 CHAMBER DRAINAGE

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

23.3.10 DISINFECTION FOLLOWING REPAIR OR REPLACEMENT

Any part of the TOWN 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 50 of these specifications.

23.4 WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 50 and the STANDARD DRAWINGS. Only 1", 1-1/2", 2", 4", 6", 8" and 12" services will be permitted. Where water services greater than 12" are required, dual services shall be provided. Water services and connections to existing TOWN systems shall be made by the CONTRACTOR.

23.5 WATER METERING

23.5.1 GENERAL

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

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

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

23.5.3 SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH PRIVATE STREETS

Individual meters are required in accordance with Section 23.5.2 if the private streets are designed to TOWN 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.

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

In general, a master meter shall be required for these developments. The developer may elect to meter each building, tenant space, etc. Master meter(s) shall be located in the public rights of way at the property line.

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

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

23.5.6 SHOPPING CENTERS

In general, shopping centers shall require installation of a fire line master meter and potable master meter. The developer may elect to have their own individual submeters to each unit may be considered on a case-by-case basis.

23.5.7 METER INSTALLATION

Meters will be installed by the TOWN after payment of applicable fees and charges, AND confirmation of full compliance with TOWN ordinances, rules, specifically service contracts, payment of all fees and changes, and CO issued. 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 inches shall be located in a meter easement located adjacent to the public right-of- way.

23.5.8 METER SIZING

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

23.6 MATERIALS, INSTALLATION AND TESTING

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

23.7 LOCATION AND IDENTIFICATION

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

23.8 CROSS-CONNECTION CONTROL

23.8.1 GENERAL

In order to protect the public water supply system from contamination due to cross-connections, the DEVELOPER shall install TOWN approved backflow prevention devices where there is the potential of a non-potable substance coming into contact with the public water system. Some of the common instances requiring installation of cross connection control devices are listed below. However, the DESIGN ENGINEER must obtain TOWN approval before finalizing the design of a Cross Connection Control Device.

23.8.2 COMMERCIAL, INDUSTRIAL AND MULTI-FAMILY RESIDENTIAL

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

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

23.8.3 IRRIGATION SYSTEMS

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

23.8.4 LOCATION AND INSTALLATION

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

PART 2 - SPECIFICATIONS

DIVISION III
GENERAL CONSTRUCTION REQUIREMENTS

SECTION 30

GRADES, SURVEY LINES AND PROTECTION OF MONUMENTS

30.1 GENERAL

30.1.1 GRADE

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

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

30.1.2 SURVEYS

The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials, and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of the TOWN 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 TOWN'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 TOWN.

30.1.3 MONUMENT PRESERVATION

Property corners and survey monuments shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be restored by a land surveyor registered in the State of Florida. All costs for this work shall be paid for by the CONTRACTOR.

30.2 UTILITY COORDINATION

30.2.1 LOCATION OF UTILITIES

Prior to proceeding with trench excavation, the CONTRACTOR shall contact all utility companies in the area to aid in locating their underground services. It shall be the CONTRACTOR's responsibility to contact utility companies at least three (3) normal working days before starting construction. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

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

30.2.2 DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

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

Wherever obstructions are encountered during the progress of the WORK, which interfere to such an extent that an alteration in the PLANS is required, the TOWN 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, sewer, telephone, electrical, or other existing utilities are an impediment to the vertical or horizontal alignment of the proposed pipe line, the TOWN shall order a change in grade or alignment or shall direct the CONTRACTOR to arrange with the owners of the utilities for their removal/relocation.

30.2.3 TEST PITS

Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the TOWN. The costs for such test pits shall be borne by the CONTRACTOR.

30.3 MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

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

1. The Maintenance of Traffic design, devices, implementation, construction, maintenance, etc. shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition, and the Florida Department of Transportation Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Green Book), latest edition.

2. The CONTRACTOR shall submit a Maintenance of Traffic Plan to the TOWN for review and approval two (2) weeks prior to construction.

3. 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 plates 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. Seventy-two (72) hours prior to closing of any streets, the CONTRACTOR shall notify and obtain the approval of responsible authorities and the TOWN.

4. Unless permission to close a street is received in writing from the proper authority (TOWN, FDOT, c 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 TOWN.

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

6. It shall be the sole responsibility of the CONTRACTOR to take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The CONTRACTOR shall be fully responsible for damage or injuries whether or not police protection has been provided.

30.4 PROTECTION OF PUBLIC AND PROPERTY

30.4.1 BARRICADES, GUARDS AND SAFETY PROVISIONS

The CONTRACTOR shall be solely responsible for adhering to the rules and regulations of OSHA and appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the CONTRACTOR at his expense during the progress of the WORK and until it is safe for traffic to use the roads and streets. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

30.4.2 PROTECTION OF UTILITY STRUCTURES

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

30.4.3 OPEN EXCAVATION

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges with 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 TOWN. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the TOWN may require special construction procedures such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment or other obstacles which could be dangerous to the public shall be well lighted at night.

30.4.4 PROTECTION OF TREES AND SHRUBS

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

30.4.5 PROTECTION OF LAWN AREAS

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

30.4.6 RESTORATION OF FENCES

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

30.4.7 PROTECTION AGAINST SILTATION AND BANK EROSION

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

30.5 ACCESS TO THE PUBLIC SERVICES

Neither the materials excavated nor the materials or equipment used in the construction of the WORK shall be so placed as to prevent free access to public services. All excavated material shall be piled in a manner that will not endanger the WORK and that will avoid obstructing streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than 2'0" from the edge of an excavation. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the WORK is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural water courses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR.

30.6 PUBLIC NUISANCE

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

30.7 CONSTRUCTION HOURS

No WORK shall be occur between dusk and dawn, or on Sundays, unless the proper and efficient prosecution of the WORK requires operations during the night or weekend. Written notification for doing the WORK shall be provided to the TOWN a minimum 72 hours before starting such items of the WORK.

30.8 CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

30.8.1 CONSTRUCTION IN EASEMENTS

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

30.8.2 CONSTRUCTION IN FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY

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

30.8.3 CONSTRUCTION IN TOWN RIGHT-OF-WAY

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

30.9 SUSPENSION OF WORK DUE TO WEATHER

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

30.10 USE OF CHEMICALS

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

30.11 COOPERATION WITH OTHER CONTRACTORS AND FORCES

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

30.12 SUBSURFACE EXPLORATION

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

30.13 CLEANING

30.13.1 DURING CONSTRUCTION

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

30.13.2 FINAL CLEANING

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

30.14 SALVAGE

Any existing TOWN owned equipment or material including but not limited to bricks, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction may be designated as salvage by the TOWN, and if so, shall be carefully excavated if necessary and delivered to the TOWN at a location within the TOWN. Any materials not claimed by the TOWN shall become the property of the CONTRACTOR and shall be properly disposed of by CONTRACTOR at his expense.

30.15 SHOP DRAWINGS AND SAMPLES

Prior to construction, the CONTRACTOR shall submit three (3) copies of the shop drawings, signed by the DESIGN ENGINEER, to the TOWN. 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 TOWN, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

SECTION 31

BORING AND JACKING

31.1 GENERAL

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

31.2 PIPE MATERIAL

31.2.1 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:

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

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

31.2.2 CARRIER PIPE

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

31.2.3 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 TOWN. 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 TOWN.

31.3 PIPE HANDLING

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

31.4 CONSTRUCTION REQUIREMENTS

31.4.1 WORK COORDINATION

It shall be the CONTRACTOR'S responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right-of-way or easement the work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR at no additional cost to the TOWN.

31.4.2 DEWATERING

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

31.4.3 CARRIER PIPE SUPPORT

The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by casing spacers. Casing spacers shall be bolt on style split shells made of either T-304 stainless steel or fusion coated steel (a minimum 0.010" thick coating of PVC shall be provided over the entire band). The shell shall be lined with a PVC liner 0.090" thick with 85-90 Durometer. All nuts and bolts shall be high strength, low alloy meeting AWWA C111. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

31.4.4 JACKING PITS

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

31.4.5 MISCELLANEOUS REQUIREMENTS

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

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

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

SECTION 32

PRESSURE CONNECTION

32.1 GENERAL

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

32.2 TAPPING SLEEVES

32.2.1 GENERAL

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

32.2.2 MECHANICAL JOINT SLEEVES

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

32.2.3 STEEL TAPPING SLEEVES

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

32.2.4 TAPPING VALVES

Tapping valves shall meet the requirements of Section 45, 50, or 60 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.

32.3 LINE STOP

All line stops shall be manufactured with a 316 SS sleeve and have a pressure rating of 150 psi. Buna-N gaskets shall be provided and all accessories (flange, completion plug, bolt kits, etc.) shall be 316 SS. A minimum 3/4" test port shall be provided in the neck of the assembly. If indicated on the Drawings, the line stop shall be capable of bypassing sewage through the assembly.

32.4 INSERTION VALVES

All insertion valves shall be provided as shown in the plans and as specified herein. Buried insertion valves shall be non-rising stem and wrench operated. The valve

assemblies shall be furnished complete and adequate for the specified or shown purpose and shall include all essential components of equipment, together with all mountings and other appurtenances normal and necessary for proper installation, whether shown or not. Insertion valves shall be equipped with a 2-inch square AWWA operating nut.

The insertion valve shall be capable of pressure-tight assembly to exterior of the pipe in which flow is to be stopped at a working pressure not to exceed 250 psi.

The insertion valve shall be constructed of a two (2) piece ductile iron or stainless steel (top and bottom) to be bolted together using ductile iron bolts with zinc alloy anodes (corrosion protection) manufactured to the ductile iron specification of ASTM 536 65-45-12.

The insertion valve shall meet AWWA material specification of C509-09 for resilient seal valves suitable for potable water service.

The valve stem shall be made of stainless steel.

The insertion valve shall use stainless steel fasteners joining the valve bonnet to the valve top casting, unless otherwise noted in assembly drawings.

Valve shall be coated with a minimum of 8 mils of fusion bonded epoxy in compliance with AWWA C550 and shall be certified to meet NSF-61.

The design of the valve shall have a satisfactory seal against the pipe exterior in the following ranges using multiple gaskets, if necessary. Valves shall conform to the operational (turns) requirements of AWWA C509-09 with specified turns to open left (counter clockwise). Valves shall be capable of working on IPS PVC, C900 PVC, cast iron, ductile iron, and asbestos cement pipe diameters.

Acceptable Manufacturers: TEAM InsertValve, EZ Valve, Insta-Valve, and Hydra-Stop, or equal.

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

1. Points of Connection, fittings to be used, and method of flushing and disinfection if applicable.

2. Estimated construction time for said connections.

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

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.

32.6 INSTALLATION

32.6.1 EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Sections 45, 50, and 60 shall apply.

32.6.2 CONSTRUCTION DETAILS

Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the CONTRACTOR's expense.

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

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

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

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

Adequate restraining devices at pipe joints or restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied. Provisions of Section 34 shall apply.

DIVISION IV
GRAVITY SEWERS, FORCE MAINS AND PUMP STATIONS

SECTION 40

GRAVITY SEWERS

40.1 GENERAL

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

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

40.2 PIPE MATERIALS

40.2.1 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The work under this Contract shall be in strict accordance with the following codes and standards.

1. All Local, County, Municipal and Federal Codes.
2. American National Standards Institute (ANSI).
3. American Society for Testing and Materials (ASTM).
4. American Water Works Association (AWWA).
5. American Association of State Highway and Transportation Officials (AASHTO).
6. Florida Department of Transportation Standard Specifications for Road & Bridge Construction (DOT).
7. Recommended Standards for Wastewater Facilities, (10-States Standards).
8. Florida Dept. of Environmental Protection

40.2.2 QUALITY ASSURANCE STANDARDS

1. American National Standards Institute, Inc. (ANSI)/American Water Works Association (AWWA):
    a. ANSI/AWWA C105, Polyethylene Encasement for Ductile - Iron Piping for Water and Other Liquids.
    b. ANSI/AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids.

c. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

d. ANSI/AWWA C115, Flanged Ductile-Iron Pipe with Threaded Flanges.

e. ANSI/AWWA C150, Thickness Design of Ductile-Iron Pipe.

f. ANSI/AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

g. ANSI/AWWA C153, Ductile Iron Compact Fittings, 3-inch through 16 inch, for water and other liquids.

h. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

i. AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

2. American Society for Testing and Materials (ASTM):

a. ASTM C828, Standard Practice for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

b. ASTM D2321, Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

c. ASTM D2412, Standard Practice for external loading properties of plastic pipe by parallel plate loading.

d. ASTM D2444, Standard Test Method for determination of the impact resistance of thermoplastic pipe and fittings by means of a TUP (falling weight).

e. ASTM D3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

f. ASTM D3212, Joints for Drain and Sewer Pipes using Flexible Elastomeric Seals.

g. ASTM F477, Standard Specification for Elastomeric seals (gaskets) for joining plastic pipe.

h. ASTM F679, Standard Specification for Poly (Vinyl Chloride) (PVC) large diameter plastic gravity sewer pipe and fittings.

40.2.3 SUBMITTALS

1. Submit manufacturer's certification of materials' conformance to specifications.

2. Submit manufacturer's literature, catalog data and installation instructions.

3. Submit certified field pressure test reports.

4. Submit pipeline video testing results.

5. Submit as-built drawings of completed system.

40.2.4 PRODUCT DELIVERY AND HANDLING

1. Exercise care to prevent damage of product during loading, transporting, unloading and storage.

2. Do NOT drop pipe or fittings.

3. Do not store directly on ground and assure that materials are kept clean. Pipe shall be kept bundled and strapped until it is ready for installation in order to prevent warping or disfiguring.

4. Store material in areas approved by the Owner.

5. Store material in such a manner as to not create a nuisance or safety hazard.

40.3 PIPE

40.3.1 GENERAL

Pipe shall be furnished free from defects impairing strength and durability and should be of best commercial quality for purpose specified. Structural properties shall be sufficient to safely sustain or withstand strains to which it is normally subjected.

40.3.2 PIPE MATERIALS

1. Ductile Iron (D.I.) ANSI/AWWA C151.:

   a. Metal Thickness, ANSI/AWWA C150:
      1) 3 Inch through 12 Inch: Pressure Class 350.
      2) 14 Inch and Larger: Pressure Class 250.
      3) Jack and Bore Crossings: Pressure Class 350.

   b. Interior Lining, 40 mils of Protecto 401 Epoxy, or equal.

   c. Exterior Coating, Bituminous Coating, 1 Mil thick.

2. Polyvinyl Chloride (PVC):

   a. Specification: ASTM D-3034 (4 Inch through 16 Inch) ASTM F679 (18 Inch through 48 Inch)

   b. Thickness: SDR 26 for sewers over 12 feet deep.

   c. All PVC gravity sewer pipe is to be green in color.

3. Pipe Joints:

   a. Ductile Iron: Push On: ANSI/AWWA C111, single gasket type.

   b. Polyvinyl Chloride: Push On: ASTM D-3212.

40.3.3 PIPE FITTINGS

1. Ductile Iron:

   a. ANSI/AWWA C110, Ductile Iron Fittings.
   b. ANSI/AWWA C153, Ductile Iron Compact Fittings.
   c. Lining: 40 mils Protecto 401 Epoxy or equal.
   d. Mechanical: ANSI/AWWA C111.
   e. Push On: AWSI/AWWA C111.
   f. Thickness: Match class of gravity main.

2. Polyvinyl Chloride:

   a. ASTM D3034, PVC Bell and Spigot Fittings.
   b. ASTM D3212, Joints.
   c. Thickness: Match SDR of gravity main.

40.3.4 FLOWABLE FILL

1. General: Excavatable Flowable Fill shall be provided for filling abandoned gravity sewers.

2. FDOT Standard Specifications for Road and Bridge Construction, Section 121.

40.3.5 CONCRETE

1. Benches and Flow Channels: 4,000 psi 28 day mix, Type II Cement.

2. Encasement: 3,000 psi 28 day mix, Type I or II Cement.

40.3.6 EXCAVATION

1. General: The CONTRACTOR shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as necessary. This shall include all necessary clearing and grubbing of any foreign substance encountered within the structure or trench area. Excavated material suitable for backfill shall be piled in an orderly manner at a sufficient distance from the trench to prevent slides or cave-ins.

2. Protection of Existing Facilities and Utilities: All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury and, in case of damage, they shall be restored by the CONTRACTOR without compensation. Existing utilities and other

underground obstructions are shown on the plans, but the accuracy of the locations and depths is not guaranteed. The CONTRACTOR shall contact all utilities prior to construction and arrange for the necessary assistance in locating and protecting the existing utilities. The CONTRACTOR shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their preconstruction or better condition.

3. Trench Excavation: The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 in. each side of pipe for unsheeted or sheeted trench, with the maximum width of trench, measured at the top of the pipe, not to exceed the outside pipe diameter, plus 24 in., unless otherwise shown on the drawings. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From the top of the pipe to the surface of the trench walls shall be as vertical as possible under soil conditions.

   No more than 300 linear feet of trench shall be open in advance of the completed pipe laying operation without prior approval of the Engineer. Pipe trenches across roadways and driveways shall be backfilled as soon as the pipe is installed. Where, in the opinion of the Engineer, adequate detour facilities are not available, no trench shall be left open across a roadway or commercial property driveway where adequate detour routes are not available for a period in excess of 30 minutes, or as directed by the governing authority. No trench shall be left open across any roadway or driveway for more than 24 hours. It shall be the CONTRACTOR 's responsibility to provide traffic control and barricades as necessary.

4. Shoring, Sheeting and Bracing: The CONTRACTOR shall design, furnish, and install all shoring, sheeting and bracing or provide other approved facilities required to perform and protect the excavation and as necessary for the safety of the public, the employees, and the preservation of existing roads, structures and other utilities. The top of such sheeting left in place shall be cut off at a minimum elevation of 2.5 ft. below finished grade. All work shall be in accordance with the Florida Trench Safety Act.

5. Pavement Removal: The CONTRACTOR shall remove pavements as part of the trench excavation. The material from permanent pavement removal shall be carefully separated from trench excavation material and properly disposed of by the CONTRACTOR.

6. Boulder Removal: All rocks, stones, boulders or concrete, having any dimension larger than permitted to be used for backfill in the paragraph entitled "Backfilling" of these Specifications, shall be removed from the site and disposed of by the CONTRACTOR.

7. Unsuitable Soil Conditions and Overdepth Excavation: In the event the project encounters unsuitable materials, the CONTRACTOR shall construct an adequate foundation to support the pipe.

a. Foundation shall consist of 12" of granular fill (No. 57 stone) or 24" of A-3 sand (ASTM D2321, Class II) compacted to 95% of maximum density (ASSHTO-T180).

b. Where granular fill foundations are used, bedding material shall be added to fill voids in foundation material prior to constructing required bedding depth.

c. Granular fill foundation shall be overlain by 4" of bedding material. Bedding material shall be A-3 sand (ASTM D2321, Class II).

d. Shape bedding material to receive pipe bells and support 1/4 of the pipe surface.

e. Limits of over-excavation shall be determined by a qualified geotechnical observer or as described on the drawings.

8. Disposal of Excess Material: The CONTRACTOR shall dispose of the excavated materials not required or suitable for backfill. All surplus excavated material which is unsuitable for fill shall become the property of the CONTRACTOR and shall be disposed of by the CONTRACTOR at his expense. Pieces of broken asphalt shall be carefully separated from suitable fill material and hauled to an asphalt plant for disposal or shall be disposed of by some other acceptable means by the CONTRACTOR at no expense to Owner. All excavated material not suitable for backfill (e.g., concrete, boulders, roots, etc.) shall be carefully separated from suitable fill material and disposed of by the CONTRACTOR at no expense to Owner. Owner has first right of refusal to accept suitable backfill material from the CONTRACTOR at no cost to the Owner.

40.3.7 INSTALLATION OF GRAVITY SEWERS AND SERVICES

1. Manufacturer's Instructions: Gravity sewer pipe shall be handled, stored and installed in strict accordance with the pipe manufacturer's instructions. A copy of the manufacturer's instructions shall be kept at the site of the work at all times by the CONTRACTOR.

2. Pipe Laying: The trench shall be excavated as specified and the bottom of the trench shall be shaped to give sufficient uniform circumferential support to the lower, one-fourth of each pipe. Pipe laying shall proceed upgrade. Each pipe shall be laid true to line and grade. As the work progresses, the interior of the pipe shall be cleaned of all dirt and superfluous materials.

   Where cleaning of the pipe after laying is difficult because of the small diameter, the CONTRACTOR shall keep a suitable swab in the pipe and shall pull the swab forward past each joint immediately after the jointing operation. At all times when the work is not in progress on the sewer lines, the CONTRACTOR shall

securely seal the open ends of all pipes in order to prevent the entrance of foreign matter. Stoppers shall be installed in the ends of all services.

In the event that it is necessary to clean the pipe by flushing with water, no water or debris shall be permitted to enter an existing or previously approved sewer. Under no conditions shall the water and debris be removed with lift station pumps or discharged into or through force mains.

3. Jointing: The bell and spigot surfaces shall be wiped free of dust, dirt, gravel or other foreign material before the application of the lubricant sealer. The resilient joint shall be connected by first brushing upon the mating surfaces the proper lubricant sealer as recommended by the pipe manufacturer. The spigot end shall then be centered on grade into the bell end of the last downstream pipe length and shoved home and properly seated with the application of moderate force by a pry or lever device. The pipes shall be jointed no later than five minutes after the application of the lubricant sealer. Jointing for connections with existing mains, or other special joints, shall be approved by the Engineer before use.

4. Building Service Laterals:

   a. The location and type (i.e., single or double) of sewer lateral shall be determined in the field. CONTRACTOR working in the area. CONTRACTOR shall be responsible for recording location of installed sewer laterals on record drawings.

   b. Sewer laterals serving dwellings whose finish floor elevation is significantly below the crown elevation of the road shall be laid at a constant 1.00% slope from the point of connection at the new gravity sewer to the property line. This is necessary so that these dwellings' sewage will be able to flow by gravity into the new gravity sewer system.

   c. Sewer laterals serving dwellings whose finish floor elevation is above the crown of the road may be brought up at a 30° to 60° angle from the elevation of the gravity sewer where there is sufficient natural fall from the dwellings to the gravity sewer (see Sewer Lateral Detail). Once the lateral has been raised to the desired elevation, it shall be installed at a constant 1.00% to the property line. Laterals shall have a minimum depth to invert of 4.00 ft at the property line based on existing grade, unless conditions or Engineer dictate otherwise.

   d. CONTRACTOR shall provide all pipe and fittings necessary to install sewer laterals from point of connection at 8-inch PVC gravity sewer to property line.

5. Connections to Existing Manholes: Pipe connections to existing manholes shall be made so that finished work will conform as

nearly as possible to essential requirements for new manhole construction. This shall include core drilling manhole, installing flexible boot connector and reconstructing the existing concrete benches and flow channel.

6. Quality Assurance: It is the responsibility of the CONTRACTOR to install the gravity sewer pipe as shown on the plans. Prior to backfilling, the CONTRACTOR shall survey each gravity sewer section (i.e. manhole to manhole) to determine actual invert elevations and slope of the pipe. Invert elevations must be within ± 0.05 ft. of design invert elevations. Resulting calculated minimum pipe slope shall be as follows, depending on diameter of gravity sewer:

Gravity Sewer Diameter (in)	Minimum Allowable Slope
4	0.85%
6	0.50%
8	0.40%
10	0.28%
12	0.22%
15	0.15%
18	0.12%
21	0.10%
24	0.08%

CONTRACTOR shall provide invert elevations to TOWN or TOWN's representative each day to verify above requirements are met. If invert elevations and/or calculated pipe slopes do not meet requirements, CONTRACTOR shall remove and reinstall gravity sewer pipe and/or manholes such that the above requirements are met, at his own expense. See Paragraph 40.3.10 for gravity sewer testing requirements.

40.3.8 SEPARATION REQUIREMENTS BETWEEN GRAVITY SEWERS AND POTABLE WATER/RECLAIMED WATER MAINS

1. Horizontal Separation: Gravity sewers shall be laid at least ten feet (outside to outside) horizontally from water mains and at least three feet (outside to outside) horizontally from any existing or proposed reclaimed water line. Smaller horizontal separation distances for gravity sewers are allowed if one or more of the following conditions is met:

   a. The top of the gravity sewer is installed at least 18-inches below the bottom of the potable water line.

   b. The gravity sewer is encased in watertight carrier pipe or concrete.

   c. Both the gravity sewer and the water main are constructed of slip-on or mechanical joint pipe complying with public water supply design standards and pressure tested to 150 psi to assure watertightness.

2. Vertical Separation: Gravity Sewers shall cross under water

mains, unless there is no alternative. Gravity sewers crossing water mains or reclaimed water lines shall be laid to provide a minimum vertical distance of 18-inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the gravity sewer. For sewer crossings, the crossing shall be arranged so that the gravity sewer pipe joints are equidistant and as far as possible from the water main joints. Adequate structural support shall be provided for the gravity sewer to maintain line and grade. For gravity sewers, smaller vertical separation distances if one of the following conditions are met.

a. The gravity sewer is encased in a watertight carrier pipe or concrete.

b. The gravity sewer is designed and constructed equal to water pipe and pressure tested to 150 psi to assure watertightness.

c. No vertical or horizontal separation distances are required for above-ground crossings.

3. Concrete Encasement of Pipe: Where concrete encasement of pipe is required for obtaining separation from other pipes or for other reasons (e.g., inadequate cover), the pipe shall be encased with 3,000 psi concrete having a minimum thickness of 6 inches all around the outside of the pipe. Pipe must be supported in trench to allow 6 inches of concrete on all sides. Concrete must be mechanically vibrated into place.

4. CONTRACTOR shall notify TOWN immediately where separation criteria cannot be met.

40.3.9 BACKFILLING

1. Material: All backfill shall be excavated material, essentially free of organic material, asphaltic concrete, clay, concrete, boulders and other deleterious material.

a. Bedding and Pipe Embedment to 12" Above Top of Pipe: The CONTRACTOR shall furnish, place, and compact AASHTO Class A-3 sandy material containing less than 1% of organics or other unsuitable material.

b. Above Pipe Embedment: The material shall be AASHTO Class A-3 material or AASHTO Class A-2-4 with prior approval from the Engineer. If the CONTRACTOR elects to use A-2-4 material, stringent moisture control will be required during the placement to achieve the required compaction, particularly during rainy periods which could cause delays in construction time.

c. Top of Backfill: The top 12 inches of the backfill shall be topsoil and/or AASHTO Class A-3 material with mixed organics.

d. Additional Fill: If sufficient suitable backfill material is not available from the excavation, additional fill meeting the above requirements shall be provided by the CONTRACTOR.

e. If deemed necessary by TOWN or its representative, backfill shall be tested for compliance with above requirements prior to placement.

2. Placing and Compaction:

a. Bedding and Pipe Embedment: The backfill shall be placed by hand under and around the pipe to the springline and compacted. Particular care shall be taken to ensure that the backfill at the pipe haunch is free from voids and is properly compacted. The backfill shall be compacted to a density of not less than 98% of maximum as determined by AASHTO T-180.

1) Above Pipe Embedment in Areas of Permanent Pavement: The backfill shall be placed in layers having a depth that will permit proper compaction but not exceeding 8" of loose measure. The backfill shall be compacted to a density of not less than 98% of maximum as determined by AASHTO T-180.

2) Above Pipe Embedment In Areas Not Under Permanent Pavement: Within rights-of-way or other areas where permanent pavement does not exist or is not proposed, (including roads, walks and driveways consisting of broken stone, gravel, clay, marl, shell, shellrock or conglomerate), the entire backfill above the pipe embedment to the subgrade of the pavement or structures shall be made with predominantly sandy material free from rock, stones or organic matter, except that rocks having a maximum dimension of 3 ½ inch will be permitted in the backfill between the elevation 1 ft. above the top of the pipe and 1 ft. below the surface. The backfill material above 1 ft. over the pipe shall be compacted to a density of not less than 90 percent of the maximum density, as determined by AASHTO T-180.

b. In areas where unpaved, stabilized roads exist, the CONTRACTOR shall restore the road to its original grade and condition. The finished stabilized road shall have a minimum LBR value of 50 for the top 12" of the roadbed.

c. Miscellaneous: Backfilling around manholes, cleanouts and other structures shall be accomplished in the same manner as the connected pipe. Extreme care shall be used in backfilling wellpoint holes to prevent voids and

settlement. If necessary, the holes should be plugged with a concrete slurry, such plugging to be at the expense of the CONTRACTOR.

d. Compaction: Shall be by hand or by mechanical tampers. Care shall be taken that the pipe is not struck by the tamper. Compaction by flooding may be allowed by written authorization of the Engineer although this will not release the CONTRACTOR of the responsibility to meet the required density.

e. The CONTRACTOR is to compact the backfill in such a manner to prevent settlement. Although the requirements of 3.04 may be met, non-settlement is not assured and CONTRACTOR is not relieved of his responsibility by such compliance.

f. PVC Pipe shall be laid and backfilled so that pipe deflection does not exceed five (5) percent.

g. The CONTRACTOR shall perform density tests at 1 foot elevation increments, starting at the base of the pipe at the following locations:

1) Within 20 feet of each manhole.
2) At a point halfway between manholes.
3) At every road lane crossing.

h. The CONTRACTOR shall perform LBR Test at a minimum of 300' on center.

40.3.9 CULVERT REMOVAL AND REPLACEMENT

1. Culverts, catch basins and other drainage structures that are removed or damaged during construction shall be replaced with materials and structures equal and similar to those removed or damaged. Manhole covers and gratings shall be set at the original elevations unless otherwise directed.

2. The CONTRACTOR shall take precautions against the entry of excavated and other loose material resulting from his operations from entering catch basins, culverts and other drainage structures in the vicinity of his operations. He shall maintain the cleanliness of these drainage structures in a condition equal to that prior to the commencement of his operations during the construction. The CONTRACTOR shall be responsible for all damage to persons, roads, buildings, vehicles and other property resulting from the failure of the CONTRACTOR to maintain these drainage structures.

40.3.10 TESTING

1. Flushing of Completed Pipelines: Each section of completed pipeline shall be as thoroughly flushed as is possible. A minimum flow shall be used for flushing that will ensure a velocity in the pipe

of 2.5 ft. per second. Water required for testing and flushing shall be furnished by the TOWN at existing pipes and outlets. CONTRACTOR shall be responsible for removal of all dirt and debris from all manholes/wetwells prior to Owner's acceptance. Any water utilized for flushing shall be properly metered and paid for by the CONTRACTOR.

2. The CONTRACTOR shall furnish all necessary equipment and labor to perform testing of all gravity sewers as set forth in the following and shall conduct such tests in the presence of the TOWN and other authorized agencies, with five days advance written notice provided.

3. The installed sewers shall be visually inspected by "lamping" between manholes, lamp holes or other structures in order to ascertain that they are clear and to correct alignment. The concentricity of the lamp image received shall be such that the diameter of said image shall have no vertical or horizontal reduction from that of the pipe inside diameter.

4. The watertightness of a sewer which has a crown lying below groundwater level shall be tested by measuring the infiltration. The watertightness of sewers having a crown 1 inch or more above groundwater level shall be tested by filling the pipe with water to produce a hydrostatic head of 2 feet or more above the crown of the sewer at the upper end of the test section or the water table outside of the sewer, whichever is higher, and then measuring the exfiltration. In no case shall the infiltration or exfiltration exceed 75 gallons per mile per inch of diameter of sewer per 24-hour day when field tested by actual infiltration conditions. If exfiltration testing is required an allowance of an additional 10 percent of gallonage shall be permitted for each additional 2-feet head over a basic 2-feet minimum internal head.

5. Leakage testing shall proceed for a continuous period of eight hours with exfiltration or infiltration amounts measured by methods approved by the TOWN. Upon application of internal hydrostatic pressure for exfiltration testing, care shall be taken to preclude unseating the joint gaskets for a specific type of pipe by exceeding the pressure capability thereof.

6. The CONTRACTOR may use, as an alternate leakage test, air testing by compressed air from manhole to manhole. Plugs, caps and branch connections must be secured against blow-off during the test. The pipe and manholes shall be free of water during the test.

    a. The air testing shall be performed in accordance with ASTM C828 for Vitrified Clay Pipe of Sizes 4 Inch through 12 Inch.

    b. Laterals shall be temporarily plugged and manhole to manhole pipe brought to a stable 3.5 psig air pressure.

    c. Air supply hose shall be shut off and time recorded.

d. Pipe section shall be acceptable if time to drop from 3.5 psig to 2.5 psig is less than or equal to one half the pipe diameter, in minutes.

7. Deflection Testing: The CONTRACTOR shall perform deflection tests of the pipe along the entire length of the sewer main. The internal diameter of the barrel shall not be reduced by more than five percent (5%) of its base inside diameter when measured not less than thirty (30) days following completion of installation. A deflection of more than the specified amount shall be cause for rejection of that particular segment of pipe located between successive manholes. All locations with excessive deflection shall be excavated and repaired by rebedding or replacement of the pipe. A properly sized nine (9) point go-no-go mandrel shall be used for testing the sewer. Deflection testing for pipe under roadways shall be performed after road base is complete.

8. Should any of 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, and all other items required to conduct the required testing, and shall perform the necessary system repairs required to comply with the specified test.

9. No installation of roadway base or paving shall occur over a gravity sewer until said section of sewer has passed all required testing including televising, lamping, leakage, and deflection.

40.3.11 PROTECTION

At the end of each workday, the mains under construction shall be plugged to prevent the entry of small animals and rodents. Temporary plugs shall be provided for this purpose.

40.3.12 RESTORATION OF DAMAGED SURFACES, STRUCTURES, AND PROPERTY

Where pavement, trees, shrubbery, fences, or other property and surface structures not designated as pay items have been damaged, removed, or disturbed by the CONTRACTOR, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances, or the specific directions of the Engineer, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the CONTRACTOR to a condition equal to that before work began within a time frame approved by the TOWN.

40.3.13 RESTORATION AND CLEAN-UP

1. Restoration:

   a. General: Restoration of areas disturbed by the CONTRACTOR's operations shall begin as soon as practical. CONTRACTOR's restoration operations shall keep pace with utility installation. TOWN reserves the right to halt utility installation until restoration and clean-up requirements are satisfied.

   b. Time Frame for Restoration: Restoration of areas disturbed by the CONTRACTOR's operations shall begin no later than 14 days and shall be completed (excluding punch list items) no later than 28 days from the time construction first began in the area. No more than 1,000 LF along the path of the work may be completely unrestored (excluding punch list items) at the end of each day.

2. Clean-up: The CONTRACTOR shall maintain the site of the work in a neat condition. The CONTRACTOR shall remove all excess materials, excess excavated materials, and all debris resulting from his operations a minimum of once per week.

SECTION 41

MANHOLES

41.1 GENERAL

Manholes shall be leak-tight and constructed of precast concrete units. Any manhole that forms a leak during the one-year warranty shall be removed and replaced with new manhole at the expense of the installing CONTRACTOR.

41.2 PRECAST CONCRETE SECTIONS

41.2.1 GENERAL

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

41.2.2 MISCELLANEOUS REQUIREMENTS

The minimum wall thickness shall be 5 inches. Precast manholes shall be constructed with a precast monolithic base structure as shown on the STANDARD DRAWINGS. The minimum base thickness shall be 8 inches.

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

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each precast 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.

Precast concrete top slabs shall be used where cover over the top of the pipe is less than 5 ft. Lift rings or non-penetrating lift holes shall be provided for handling precast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

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

Manholes receiving flow from wastewater force main shall be lined as per Section 43.3.

41.2.3 INSPECTION

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

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

41.3.4 CASTINGS

Gray iron castings for manhole frames, covers, adjustment rings and other items shall conform to the ASTM Designation A48, Class 35B. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Lifting rings shall be cut off and patched after assembly of manhole is completed. Casting patterns shall conform to those shown or indicated on the STANDARD DRAWINGS. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation. In certain locations, bolt down covers and gasketed covers shall be located as shown on the DRAWINGS (i.e., flood prone areas).

41.3 CONSTRUCTION DETAILS

41.3.1 BEDDING

Base sections shall be placed on bedding rock conforming to the requirements in Section 40. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast element. Refer to Section 40 for density requirements. Refer to the STANDARD DRAWINGS for additional bedding details.

41.3.2 CAST-IN-PLACE BASES

Cast-in-place bases shall be utilized only when specifically approved by the TOWN. Unless otherwise specified, cast-in-place bases shall be at least eight (8) inches in thickness and shall extend at least six (6) inches radially outside

of the outside dimension of the manholes section. Anti-floatation, reinforcement, and connection to the riser sections shall be designed by the DESIGN ENGINEER and submitted to the TOWN for approval.

41.3.3 PRECAST MANHOLES

A precast 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.

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

Precast 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.

41.3.4 EXCAVATION AND BACKFILLING

Requirements of Section 40 shall apply.

41.3.5 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 C270, type M. and the bricks shall be clay and conform to ASTM C216, grade SW, size 3-1/2" (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.

41.3.6 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.

41.3.7 PIPE CONNECTIONS

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

41.3.8 DROP MANHOLE CONNECTIONS

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

41.4 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.

41.5 INSPECTION FOR ACCEPTANCE

No visible leakage in the manhole or at pipe connections shall be permitted. All manholes shall be inspected by the TOWN prior to acceptance. All manholes failing to meet the specification set forth in Section 41 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 42

WASTEWATER FORCE MAIN

42.1 GENERAL

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

Pipe used in wastewater (transmission) force main systems shall be Polyvinyl Chloride (PVC), unless otherwise approved by the Town. Pipe used at pumping stations and lift stations shall include ductile iron pipe (DIP).

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

42.1.1 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The work under this Contract shall be in strict accordance with the following codes and standards.

1. All local, county, municipal, and federal codes.
2. American National Standards Institute (ANSI).
3. American Society for Testing and Materials (ASTM).
4. American Water Works Association (AWWA).
5. American Association of State Highway and Transportation Officials (AASHTO).
6. Florida Department of Transportation Specifications (DOT).
7. Recommended Standards for Wastewater Facilities (10-States Standards).
8. Florida Dept. of Environmental Protection.

42.1.2 QUALITY ASSURANCE STANDARDS

1. American National Standards Institute, Inc. (ANSI)/American Water Works Association (AWWA), latest edition:
    a. ANSI/AWWA C105, Polyethylene Encasement for Ductile - Iron Piping for Water and Other Liquids.
    b. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

c. ANSI/AWWA C115, Flanged Ductile-Iron Pipe with Threaded Flanges.

d. ANSI/AWWA C150, Thickness Design of Ductile-Iron Pipe.

e. ANSI/AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

f. ANSI/AWWA C153, Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids.

g. AWWA C508, Swing-Check Valves for Waterworks Service, 2 In. Through 24 In.

h. AWWA C515, Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service

i. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

j. AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

k. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution.

l. AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe, 14-inch through 48-inch for Water Transmission and Distribution.

2. American Society for Testing and Materials (ASTM):

a. D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

b. D-2464, Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fillings, Schedule 80.

c. D2467, Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

d. D2564, Solvent Chemicals for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

e. D2855, Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

3. Manufacturer's name and model numbers are listed to establish a standard of quality. Equivalent items of other manufacturers are acceptable.

42.1.3 SUBMITTALS

1. Submit manufacturer's certification of materials' conformance to specifications.

2. Submit manufacturer's literature, catalog data and installation instructions.

3. Submit certified field pressure test reports.

42.1.4 PRODUCT DELIVERY AND HANDLING

1. Exercise care to prevent damage of product during loading, transporting, unloading and storage.

2. Do NOT drop pipe or fittings.

3. Do not store directly on ground and assure that materials are kept clean. Pipe shall be kept bundled and strapped until it is ready for installation in order to prevent warping or disfiguring.

4. Store material in such a manner as to not create a nuisance or safety hazard.

42.2 PIPE

42.2.1 GENERAL

Pipe shall be furnished free from defects impairing strength and durability and should be of best commercial quality for purpose specified. Structural properties shall be sufficient to safely sustain or withstand strains to which it is normally subjected.

42.2.2 PIPE MATERIALS

1. Ductile Iron (D.I.) ANSI/AWWA C151.:

   a. Metal Thickness, ANSI/AWWA C150:

      1) 3 Inch through 12 Inch: Pressure Class 350.
      2) 14 Inch and Larger: Pressure Class 250.
      3) Jack and Bore Crossings: Pressure Class 350.

   b. Interior Lining, 40 mils of Protecto 401 Ceramic Epoxy or equal.

   c. Exterior Coating, Bituminous Coating, 1 Mil thick.

2. Polyvinyl Chloride (PVC), 14-in. and larger:

   a. Specification: AWWA C905.

   b. Compound: PVC 12454-B, ASTM D1784.

   c. Thickness: Class 165, DR 25.

3. Polyvinyl Chloride (PVC) 4 In. Through 12 In.:

   a. Specification: AWWA C900.

   b. Compound: PVC 12454-B, ASTM D 1784.

   c. Thickness: Class 235, DR 18.

4. Polyvinyl Chloride (PVC), 3-inch:

   a. Specification: ASTM D2241.

   b. Compound: PVC 12454-B, ASTM D1784.

   c. Thickness: Class 200, SDR 21.

5. Polyvinyl Chloride (PVC), 2 1/2 In. and Smaller:

   a. Specification: ASTM D1785.

   b. Compound: PVC 12454-B, ASTM D1784.

   c. Thickness: Schedule 80.

42.2.3 PIPE JOINTS

1. Ductile Iron:

   a. Mechanical: ANSI/AWWA C111.

   b. Push On: ANSI/AWWA C111, single gasket type.

   c. Flanged: ANSI B16.1, 125lb.

   d. Restrained: Acceptable: Lock-Fast, American Ductile Iron Pipe, TR Flex, U.S. Pipe, Super-Lock, Clow Corporation, Megalug 1100 and 1700 Series, or equal.

2. Polyvinyl Chloride, 3 In. Through 12 In.:

   a. Push On: ASTM F477 Elastomeric Gaskets

   b. Restrained: UNI-BELL B-13, Uni-Flange Restrainer, Megalug 2000 and 1600 Series, or equal.

   c. Polyvinyl Chloride, 2 1/2 In. and Smaller:

      1) Screwed: ASTM D2464.

      2) Solvent Weld: ASTM D2855.

      3) Solvent: ASTM D2564.

3. Pipe Fittings:

   a. Ductile Iron and Polyvinyl Chloride (PVC) 3 In. and Larger:

      1) ANSI/AWWA C153, compact fittings.

      2) Mechanical: ANSI/AWWA C111.

      3) Push On: AWSI/AWWA C111.

      4) Flanged: ANSI B16.1, 125 lb.

      5) Restrained-Ductile Iron: Same as Ductile Iron Pipe Joints.

      6) Restrained-PVC: Same as PVC Pipe Joints.

      7) Linings and Coatings: Same as for Ductile-Iron Pipe.

   b. Polyvinyl Chloride (PVC) 2 1/2 In. and Smaller:

      1) ASTM D2464, Schedule 80 PVC threaded fittings.

      2) ASTM D2467, Schedule 80 PVC socket type fittings.

      3) ASTM D2855, solvent weld joints.

4. Pipe Marking and Identification:

   a. Ductile Iron Pipe: Permanent marking tape, with the words "SANITARY FORCE MAIN" printed along the tape, shall be attached to the pipe for its entire length. In addition, similar marking tape shall be placed in the trench over the pipe, six to twelve inches below finished grade, for the entire length of pipe.

   b. PVC Pipe: All PVC force main pipe shall be manufacturer's standard green color for sanitary force mains. In addition, permanent marking tape with the words "SANITARY FORCE MAIN" shall be placed in the trench over the pipe, six to twelve inches below finish grade, for the entire length of pipe.

      In addition, all PVC or HDPE force main pipe installed underground shall have a #12 gauge, solid strand, type UF insulation trace wire (green in color for sewer) attached for locating purposes. Half hitches shall be made behind each pipe bell and on each side of a valve or fitting. Branch splices shall be made at all tees and service lines. Trace wire shall be run into valve boxes as shown on valve detail. Watertight splicing connectors shall be utilized for all splices. CONTRACTOR shall be responsible for continuity of trace wire.

5. Above-ground piping coatings: Non-Submerged Ferrous Metals (Includes all exposed piping, valves, fittings, and supports which are not aluminum, galvanized or stainless steel).

   a. Surface Preparation: Degrease before proceeding. SSPC-SP-10 Near-White Blast Cleaning. Coat all steel before any rust bloom

forms. The surface should be dry and free of any contamination. Consult the manufactures application instructions for the recommended Blast profile.

b. Primer: High-build polyamide epoxy primer applied at 6.0 mils DFT. Use Sherwin-Williams Macropoxy 646 Fast Cure Epoxy, or equal.

c. Finish: Polyurethane applied at 4.0 mils. Use Sherwin-Williams Acrolon 218 HS Acrylic Polyurethane, or equal.

Minimum system dry film thickness 10.0 mils. All colors shall be in accordance with 10 State Standards as approved by the TOWN.

42.3 PLUG VALVES

42.3.1 Non-lubricated, eccentric plug type with cast iron body, stainless steel bearings, balanced plug coated with E.P.T. (ethylene-propylene terpolymer or neoprene).

1. Minimum port area:

   a. Valves less than 24 inch: 80% of pipe area
   b. Valves 24 inch or larger: 70% of pipe area

2. Valve shall be designed for easy conversion from wrench-operated to gear-operated in field.

3. Operators: All valves 8 inch or larger shall have totally enclosed worm and gear operators.

4. Accessories:

   a. Buried Valves 6 Inch and Smaller: Provide 2-inch square nut.

   b. Buried Plug Valves 8 Inch or Larger: Provide buried worm gear activator.

   c. Valves Not Buried: Provide handwheels for valves equipped with geared operators and valve wrenches of adequate size and length for all valves without geared operators.

   d. Acceptable Manufacturers or Equal: DeZurik, Val-Matic, or equal.

42.4 GATE VALVES (2-inch and larger)

42.4.1 Shall be AWWA C515, iron body, resilient seat, non-rising bronze stem with 2" square operating nut on buried valves, turn to left (counter clockwise) to open.

42.4.2 Working pressure of 200 psi.

42.4.3 Internal Metal Surfaces shall have two-part thermosetting epoxy coating, 4 mils thick meeting AWWA C550.

42.4.4 Sealing Mechanism shall have zero leakage at 200 psi with flow in either direction.

42.4.5 End Conditions:

1. Above ground, ≥ 2-inch: Flanged Joint
2. Below ground, ≥ 3-inch: Mechanical Joint
3. Below ground, 2-inch and 2-1/2-inch: Threaded Joint

42.4.6 Acceptable Manufacturers: Mueller, American, or equal.

42.5 CHECK VALVES

42.5.1 Shall be AWWA C508, cast iron or steel body, resilient coated disc ring, bronze seating ring, stainless steel bolting and hinge pin, and outside pin and lever.

42.5.2 Swing type with weighted cantilever operator and externally mounted piston operated cushion chamber to prevent slamming or hammering.

42.5.3 Swing shaft shall be non-corrosive material (303 stainless steel).

42.5.4 Rated to 175 psig operating pressure.

42.5.5 Interior surface shall be epoxy coated in accordance with AWWA C550.

42.5.6 Acceptable: Golden Anderson, Mueller, American, or equal.

42.6 VALVE BOXES

42.6.1 Provide at all manually operated valves installed on underground lines.

42.6.2 ASTM A48, cast iron, Class 30-B, 3-piece screw extension type, with cover marked “SEWER” and flared base to suit valve furnished.

42.6.3 Acceptable: Figure No. F-2450, Clow Corporation; Catalog No. H10357, Mueller Co.; Figure No. E-3002, M & H Valve and Fittings Co. or equal.

42.7 WASTEWATER AIR RELEASE VALVE

All force mains and other pressure non-treated mains shall have air and vacuum release valves installed as they are indicated on the plans. The body of these valves shall be conical shaped to maintain maximum air gap with the spring-loaded float and seal plug connection combining to ensure no contact between the sewage and the seal. The valve shall have a double float design with the upper float being enclosed in the upper section of the valve and shall be made of polypropylene. The lower float shall be in the main body of the valve and shall be constructed of 316 stainless steel or foam polypropylene. The body, cover flange, and lower flange shall be constructed of 316 stainless steel, and shall have a funnel shaped lower body to automatically drain sewage back into the system. All internal metal parts are to be made from corrosion resistant 316 stainless steel, with all operating parts in the upper and lower sections to be non-metallic plastic materials. The hinge for operation for the opening and closing of the seal on the orifice shall be made of EPDM rubber. The rolling resilient seal shall provide smooth positive opening, closing, and leak-free sealing over the fluctuation of pressure differentials. The

working pressure shall be 150 psi and tested to 230 psi. All hardware shall be of stainless steel bolts and nuts, and the entire valve, except to upper outlet, shall be constructed of 316 stainless steel. All valves shall be equipped for backflushing maintenance with easy connection or disassembly. Valves with a total weight of more than 45 pounds shall be anchored to relieve the excessive weight to the saddle and PVC pipe. Those valves weighing less than 45 pounds will not be required to be anchored. The connection on all pipelines shall be the following sizing with an isolation valve of the same size:

8-inch and smaller	2-inch threaded
10-inch through 16-inch	3-inch flange
18-inch through 24-inch	4-inch flange
30-inch through 48-inch	6-inch flange
54-inch and larger	8-inch flange

All air and vacuum combination release valves shall be Model ARI D- 020S, ARI D-025SS, or approved equal, and the automatic air release valves shall be ARI Model S-020S or approved equal. All valves shall be installed in accordance with manufacturer recommendations and shall have an isolation valve connection for control. All ARV shall have ISO 9002 certification in order to be supplied on this project.

42.8 TAPPING SADDLES

All tapping saddles shall be suitable for the size and type of pipe being tapped. Saddle for pipe 4-inch and larger shall be brass with stainless steel double band and bolts. Acceptable: Ford 202BS or equal. Saddles for pipe less than 4-inch diameter shall be Ford S70 or 202B, as required, or equal.

42.9 CORPORATION STOPS

Corporation Stops shall be Mueller, Hayes or Ford threaded on the inlet side with Mueller threads and the outlet side fitted with connections to suit the connecting pipe or appurtenance.

42.10 PLASTIC LOCATING AND MARKING TAPE

Tape shall be plastic coated foil with a minimum width of 2 inches. Tape shall be highly visible and shall have the words “SANITARY FORCE MAIN” in at least 1" letters printed at least every 36 inches along the tape. Tape shall be Allen Marking Tape, or equal.

42.11 PRESSURE GAUGE ASSEMBLIES

42.11.1 Pressure gauges shall be glycerin filled, 4-1/2" dial and black numerals on white background and fully compatible with pressure sensor. They shall have a 1/4" mounting and be provided with blowout protection.

1. Provide stainless steel bourdon tube and movement and 316 stainless steel or noncorrosive case with safety glass lens and threaded lens retaining ring.

2. Provide adjustable pointer with overpressure stop and zero pointer stop.

3. Pressure gauge shall be accurate to + 1% of full range. Range shall be such that normal operating pressure is at midrange of scale.

4. Diaphragm protection seals and gauges shall be fitted at factory. Seals shall be removable for cleaning without disturbing the diaphragm.

5. Acceptable Manufacturers: Ashcroft, McDaniel, Ametek, General Instruments, Wika, or equal.

42.11.2 Pressure Sensor shall be flanged type with 360 circumferential reading.

1. Instrument shall be capable of being through bolted in-line with a 125# flange with full face gaskets.

2. Pressure sensor shall be factory sealed and capped, capable of operating pressures to 200 psi.

3. Body and end covers of sensors shall be 316 stainless steel and sleeve material shall be Buna-N rubber.

4. Flow passages of sensor shall be self-cleaning.

5. Pressure sensor shall be equal to the Series 40 as manufactured by the Red Value Co.

42.12 EXCAVATION

42.12.1 GENERAL

The CONTRACTOR shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as necessary. This shall include all necessary clearing and grubbing of any foreign substance encountered within the structure or trench area. Excavated material suitable for backfill shall be piled in an orderly manner at a sufficient distance from the trench to prevent slides or cave-ins.

42.12.2 PROTECTION OF EXISTING FACILITIES AND UTILITIES

All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury and, in case of damage, they shall be restored by the CONTRACTOR without compensation. Existing utilities and other underground obstructions are shown on the plans, but the accuracy of the locations and depths is not guaranteed. The CONTRACTOR shall contact all utilities prior to construction and arrange for the necessary assistance in locating and protecting the existing utilities. The CONTRACTOR shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition.

42.12.3 TRENCH EXCAVATION

All excavation shall be in accordance with the Florida Trench Safety Act. The minimum width of the trench shall be equal to the outside diameter of the pipe

at the joint plus 8 in. each side of pipe for unsheeted or sheeted trench, with the maximum width of trench, measured at the top of the pipe, not to exceed the outside pipe diameter, plus 24 in., unless otherwise shown on the drawings. Trench walls shall be maintained vertical from the bottom of the trench to a line measured at the top of the pipe. From the top of the pipe to the surface of the trench walls shall be as vertical as possible under soil conditions.

No more than 300 linear feet of trench shall be open in advance of the completed pipe laying operation without prior approval of the TOWN. Pipe trenches across roadways and driveways shall be backfilled as soon as pipe is installed. Where, in the opinion of the TOWN, adequate detour facilities are not available, no trench shall be left open across a roadway or commercial property driveway where adequate detour routes are not available for a period in excess of 30 minutes, or as directed by the governing authority. No trench shall be left open across any roadway or driveway for more than 24 hours. It shall be the CONTRACTOR's responsibility to provide suitable traffic control and barricades as necessary meeting governing jurisdiction (i.e., TOWN, County, FDOT, etc).

42.12.4 SHORING, SHEETING AND BRACING

The CONTRACTOR shall design, furnish and install all shoring, sheeting and bracing or provide other approved facilities required to perform and protect the excavation and as necessary for the safety of the public, the employees, and the preservation of existing roads, structures and other utilities. The top of such sheeting left in place shall be cut off at a minimum elevation of 2.5 ft. below finished grade.

42.12.5 PAVEMENT REMOVAL

The CONTRACTOR shall remove pavements as part of the trench excavation. The material from permanent pavement removal shall be carefully separated from trench excavation material and disposed of by the CONTRACTOR.

42.12.6 BOULDER REMOVAL

All rocks, stones, boulders or concrete, having any dimension larger than permitted to be used for backfill in the paragraph entitled "Backfilling" of these Specifications, shall be removed from the site and disposed of by the CONTRACTOR.

42.12.7 UNSUITABLE SOIL CONDITIONS AND OVERDEPTH EXCAVATION

Where determined by the TOWN or its representative that the soils encountered in the utility trench excavation are unsuitable for pipe bedding and/or backfill, the depth of excavation shall be increased as directed by the TOWN or its representative. The bottom of the excavation shall be brought up to the proper excavation elevation utilizing suitable and properly-compacted backfill material or bedding material as directed by the Engineer or his representative. Bedding material if required, shall consist of ½" to 1" diameter stone placed in bottom of trench at a thickness of 4 to 6 inches. Suitable backfill material shall then be installed and compacted over pipe as

described in Paragraph 42.15. CONTRACTOR shall be compensated for removal and replacement of unsuitable soils in accordance with applicable bid items.

42.12.8 DISPOSAL OF EXCESS MATERIAL

The CONTRACTOR shall dispose of the excavated materials not required or suitable for backfill. All surplus excavated material which is unsuitable for fill shall become the property of the CONTRACTOR and shall be disposed of by the CONTRACTOR at his expense. Pieces of broken asphalt shall be carefully separated from suitable fill material and hauled to an asphalt plant for disposal or shall be disposed of by some other acceptable means by the CONTRACTOR. All excavated material not suitable for backfill (e.g., concrete, boulders, roots, etc.) shall be carefully separated from suitable fill material and disposed of by the CONTRACTOR. TOWN has the option to accept suitable backfill material from the CONTRACTOR.

42.13 INSTALLATION OF FORCE MAINS

42.13.1 GENERAL

Unless otherwise noted on the drawings or in other sections of this Specification, the pipe shall be handled and installed in strict accordance with the manufacturer's instructions and with the applicable AWWA or ASTM Standards.

1. Ductile Iron Pipe: AWWA C600.

2. Polyvinyl Chloride Pipe: ASCE Manual No. 37, ASTM D2321.

3. If a conflict exists between the manufacturer's instructions and the AWWA or ASTM Standards, the manufacturer's instructions shall govern.

4. Examine area to receive pipe work for defects that adversely affect execution of work or cause deviation beyond allowable tolerances for piping clearances.

5. Carefully examine each section of pipe or valve before installation. Do not use defective or damaged pipe or materials. Remove such pipe or material from project site immediately.

42.13.2 PREPARATION

The CONTRACTOR shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals and other foreign material that would hinder the operation of the pipeline. All valves installed in main shall be kept tightly closed during installation. Where the groundwater elevation is above the bottom of the trench, the CONTRACTOR shall provide suitable dewatering equipment. All piping shall be placed in a dry trench, unless wet trench installation is approved by the Engineer.

42.13.3 DEPTH OF COVER

Unless otherwise shown on the drawings, or otherwise authorized by the TOWN, the pipe shall have a minimum cover of 36 inches.

42.13.4 CONNECTIONS TO EXISTING MAIN

The CONTRACTOR shall make connections to existing mains as shown on the drawings. Connections shall be made only after arrangements have been completed by the CONTRACTOR with the TOWN and shall be under the TOWN's immediate supervision. CONTRACTOR shall be required to restrain existing pipe as necessary in accordance with pipe restraint schedule.

42.13.5 PIPE THRUST RESTRAINTS

Mechanical restrainers shall be installed as required to properly restrain all piping systems. At a minimum, restrainers shall be provided on all below-grade valves and fittings and at the required number of pipe joints in each direction. Required lengths of restrained pipe shall be as shown in pipe restraint schedule at end of this paragraph for the type of soil encountered. For above-grade piping, all valves and fittings shall be threaded, flanged or solvent welded with supports as required.

PIPE RESTRAINT SCHEDULE

MINIMUM LENGTH OF PIPE (IN FEET) REQUIRED TO BE RESTRAINED ON EACH SIDE OF A VALVE OR FITTING FOR SANDY SOILS (SW, SP, SM, SC)

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
PVC PIPE	≤4	18	18	18	18	18	22	36	18	52
	6	24	18	18	18	18	30	38	36	73
	8	31	18	18	18	18	40	69	36	96
	10	37	18	18	18	18	48	93	54	115
	12	43	18	18	18	18	56	99	54	136
	14	49	20	18	18	18	64	101	72	155
	16	55	23	18	18	18	72	103	72	174
	18	60	25	18	36	20	80	104	72	192
	20	65	27	18	36	21	87	105	72	211
	24	75	31	18	36	25	102	134	90	246
	30	88	37	18	36	29	122	185	90	295

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
DUCTILE IRON	≤4	18	18	18	18	18	18	18	18	33
	6	20	18	18	18	18	19	35	36	47
	8	26	18	18	18	18	25	44	36	61
	10	31	18	18	18	18	30	60	54	73
	12	37	18	18	18	18	36	63	54	86
	14	41	18	18	18	18	41	64	72	98
	16	46	19	18	36	18	46	66	72	111
	18	51	21	18	36	18	51	66	72	122
	20	56	23	18	36	18	56	67	72	134
	24	64	27	18	36	21	65	85	90	156
	30	75	31	18	36	25	78	118	90	188

PIPE RESTRAINT SCHEDULE

MINIMUM LENGTH OF PIPE (IN FEET) REQUIRED TO BE RESTRAINED ON EACH SIDE OF A VALVE OR FITTING FOR CLAYEY AND SILTY SOILS (CL, CH, ML, MH)

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
PVC PIPE	≤4	19	18	18	18	18	23	36	18	55
	6	26	18	18	18	18	32	40	36	77
	8	35	18	18	18	18	42	73	36	101
	10	42	18	18	18	18	50	98	54	121
	12	50	21	18	18	18	59	104	54	143
	14	57	23	18	36	20	67	106	72	163
	16	64	27	18	36	23	76	109	72	183
	18	71	29	18	36	25	84	109	72	202
	20	78	32	18	36	28	92	110	72	221
	24	92	38	18	36	33	107	140	90	258
	30	110	46	22	54	40	127	193	90	308

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
DUCTILE IRON	≤4	18	18	18	18	18	18	18	18	35
	6	22	18	18	18	18	20	25	36	49
	8	29	18	18	18	18	27	46	36	64
	10	35	18	18	18	18	32	62	54	77
	12	41	18	18	18	18	37	66	54	90
	14	47	20	18	18	18	43	67	72	103
	16	53	22	18	36	19	48	68	72	115
	18	59	24	18	36	21	53	69	72	127
	20	65	27	18	36	23	58	70	72	140
	24	76	31	18	36	27	67	89	90	162
	30	91	38	18	36	32	80	122	90	194

Assumptions: 1. Pipe Test Pressure = 150 PSI
2. Minimum Pipe Depth = 3.0 Feet
3. Laying Condition = Type 5
4. Safety Factor = 2.0

a "Low" represents the minimum length of pipe (in feet) required to be restrained on the low side of the vertical offset, which is typically downstream of the offset fitting. "High" represents the minimum length of pipe (in feet) required to be restrained on the high side of the vertical offset, which is typically upstream of the offset fitting. Required restrained lengths assume an offset angle ≤ 45°.

b Distance represents the linear feet of large diameter pipe upstream of the reducer required to be restrained. Restrain small diameter pipe at reducer at a minimum. If there is an unobstructed run downstream of the reducer (i.e. small diameter pipe) of at least 2.5 times the required length of large diameter pipe to be restrained, then restraint is required only at the reducer fitting. If small end of reducer is more than three pipe sizes smaller than large end, consult Engineer for required length to be restrained.

42.14 SEPARATION REQUIREMENTS BETWEEN FORCE MAINS AND POTABLE WATER/RECLAIMED WATER MAINS

42.14.1 HORIZONTAL SEPARATION

Force mains shall be laid at least ten feet (outside to outside) horizontally from water mains at least three feet (outside to outside) horizontally from any existing or proposed reclaimed water line. Smaller horizontal separation distances for force mains are allowed if one of the following conditions is met:

1. The top of the force main is installed at least 18-inches below the bottom of the potable water line.

2. The force main is encased in watertight carrier pipe or concrete.

3. Both the force main and the water main are constructed of slip-on or mechanical joint pipe complying with public water supply design standards and pressure tested to 150 psi to assure watertightness.

42.14.2 VERTICAL SEPARATION

Force mains shall cross under water mains, unless there is no alternative. Force mains crossing water mains or reclaimed water lines shall be laid to provide a minimum vertical distance of 18-inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the force main. For sewer crossings, the crossing shall be arranged so that the force main pipe joints are equidistant and as far as possible from the water main joints. For force mains, smaller vertical separation distances if one of the following conditions are met.

1. The force main is encased in a watertight carrier pipe or concrete.

2. The force main is designed and constructed equal to water pipe and pressure tested to 150 psi to assure watertightness.

3. No vertical or horizontal separation distances are required for above-ground crossings.

42.14.3 CONCRETE ENCASEMENT OF PIPE

Where concrete encasement of pipe is required for obtaining separation from other pipes or for other reasons (e.g., inadequate cover), the pipe shall be encased with 3,000 psi concrete having a minimum thickness of 6 inches all around the outside of the pipe. Pipe must be supported in trench to allow 6 inches of concrete on all sides. Concrete must be mechanically vibrated into place. The Engineer or his representative must be present at the time of encasement.

42.14.4 CONTRACTOR shall notify the TOWN immediately where separation criteria cannot be met.

42.15 BACKFILLING

42.15.1 MATERIAL

All backfill shall be excavated material, essentially free of organic material, asphaltic concrete, clay, concrete, boulders and other deleterious material.

1. Bedding and Pipe Embedment: The material in the bedding, around the pipe and to a depth of 1 ft. over the pipe, shall be sand or a mixture of sand, shell or crushed stone properly graded and mixed so that fine grain material from the side walls of the trench or backfill above the embedment will not migrate into the backfill material. The backfill shall meet the following limitations.

    a. Ductile Iron Pipe: All material shall pass through a 3/4 in. square opening laboratory sieve.

    b. Plastic Pipe: All materials shall pass through a 1/2 in. square opening laboratory sieve.

2. Above Pipe Embedment: The material shall be sand or a mixture of sandy material with rock, stone and shell. Rock, stone, and shell shall pass through a 3-1/2 inch ring.

3. Top of Backfill: The top 12 inches of the backfill shall be topsoil and/or sandy material.

4. Additional Fill: If sufficient suitable backfill material is not available from the excavation, additional fill meeting the above requirements shall be provided by the CONTRACTOR.

42.15.2 PLACING AND COMPACTION

1. Under Pavement: Where the excavation is made through existing or proposed pavements, including shoulders, curbs, driveways, sidewalks, or structures, the entire backfill to the subgrade of the pavement or structures shall be made with predominantly sandy material free from rock, stones or organic matter, except that rocks

passing a 3-1/2 inch ring will be permitted in the backfill between the elevation one foot above the top of the pipe and the bottom of the pavement subgrade.

The entire backfill material, including the material placed around and one foot above the pipe, shall be compacted to a density of not less than 98% of the maximum density, as determined by AASHTO T-180, in 12" lifts. Particular care shall be taken to ensure that the backfill at the haunch is free from voids and is properly compacted. Compaction by flooding or puddling will be permitted only by written authorization from the Engineer.

Roads, walks and driveways consisting of broken stone, gravel, clay, marl, shell, shellrock, or a conglomerate of such materials, are not considered as being permanent pavement.

2. In Areas Not Under Permanent Pavement: Within rights-of-way or other areas where permanent pavement does not exist or is not proposed, including roads, walks and driveways consisting of broken stone, gravel, clay, marl, shell, shellrock or conglomerate, the entire backfill to the subgrade of the pavement or structures shall be made with predominantly sandy material free from rock, stones or organic matter, except that rocks having a maximum dimension of 3 ½ inch will be permitted in the backfill between the elevation 1 ft. above the top of the pipe and 1 ft. below the surface. Particular care shall be taken to ensure that the backfill at the haunch is free from voids and is properly compacted. The bedding and embedment shall be compacted to a density of not less than 98 percent of maximum as determined by AASHTO T-180, in 12" lifts. The backfill material above 1 ft over the pipe shall be compacted to a density of not less than 90 percent of the maximum density, as determined by AASHTO T-180, in 12" lifts. Compaction by flooding or puddling will be permitted only by written authorization from the Engineer.

   In areas where unpaved, stabilized roads exist, the CONTRACTOR shall restore the road to its original grade and condition. The finished stabilized road shall have a minimum LBR value of 50 for the top 12" of the roadbed.

3. Miscellaneous: Backfilling around meter boxes, valve boxes and other structures shall be accomplished in the same manner as the connected pipe. Extreme care shall be used in backfilling wellpoint holes to prevent voids and settlement. If necessary, the holes should be plugged with a concrete slurry, such plugging to be at the expense of the CONTRACTOR.

4. Compaction Tests: The TOWN or its representative may at any time instruct the CONTRACTOR to partially excavate a previously backfilled trench or temporarily backfilling of a short section of the trench for the purpose of obtaining measurements of the density of the backfill. All density testing shall be paid for by the CONTRACTOR. Density tests shall be taken along the pipe a minimum of every 300 feet, at each road lane crossing, and as directed by the TOWN. Density tests shall be taken in one-foot lifts from bottom of trench to finished grade.

42.16 CULVERT REMOVAL AND REPLACEMENT

42.16.1 Culverts, catch basins and other drainage structures that are removed or damaged during construction shall be replaced with materials and structures equal and similar to those removed or damaged. Manhole covers and gratings shall be set at the original elevations unless otherwise directed.

42.16.2 The CONTRACTOR shall take precautions against the entry of excavated and other loose material resulting from his operations from entering catch basins, culverts and other drainage structures in the vicinity of his operations. He shall maintain the cleanliness of these drainage structures in a condition equal to that prior to the commencement of his operations during the construction. The CONTRACTOR shall be responsible for all damage to persons, roads, buildings, vehicles and other property resulting from the failure of the CONTRACTOR to maintain these drainage structures.

42.17 TESTING

42.17.1 FLUSHING OF COMPLETED PIPELINES

Each section of completed pipeline shall be thoroughly flushed. A minimum flow shall be used for flushing that will ensure a velocity in the pipe of 2.5 ft. per second. Water required for testing and flushing will be furnished by the TOWN at existing pipes and outlets. CONTRACTOR shall slowly fill system to eliminate air pockets, then flush to remove particulates. Flushing shall comply with Figures 1 and 2, and Table 3 of AWWA C651. Provide corporation stops at any high points in line in order to bleed air from piper. CONTRACTOR shall make provisions to properly dispose of water from his flushing operations. Flooding of streets and private property shall not be permitted. CONTRACTOR shall arrange with TOWN 72 hours in advance of the time of flushing for the availability of water. Water required for testing and flushing shall be furnished by the TOWN from a potable water source satisfactory to the TOWN. CONTRACTOR shall be required to meter and pay for any water used for flushing.

42.17.2 LEAKAGE TEST

Leakage and pressure tests shall be conducted in the presence of the TOWN. The CONTRACTOR shall provide all necessary apparatus including a pump, flow measuring device, piping connections and fittings and the necessary labor to conduct the tests. The test shall be of not less than two (2) hours in duration. During the test, the pipe being tested shall be maintained at a pressure of not less than 100 psi. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage shown by test. Lines which fail to pass tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves, and accessories shall be removed and replaced. The pipe lines shall be tested in sections between every consecutive in-line valve unless otherwise directed by the TOWN. The line shall be filled with water and all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the CONTRACTOR. Accurate means shall be provided by the CONTRACTOR for measuring the makeup water required to maintain this pressure. Leakage is defined as the quantity

of makeup water added to the pipe being tested during the test period. No pipe installation will be accepted if the leakage exceeds the quantities specified in AWWA C605-05, which is represented by the following equation.

Where:
Q = Quantity of makeup water (allowed) in gallons per hour
L = Length of pipe section being tested, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge)

42.17.3 TESTING PLAN

The CONTRACTOR must review his plan for testing with the TOWN at least two (2) working days before starting the test. The CONTRACTOR shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the Engineer. Any damage to the pipe coating shall be repaired by the CONTRACTOR. Lines shall be totally free of debris prior to final acceptance.

42.18 PROTECTION

At the end of each workday, the mains under construction shall be plugged to prevent the entry of small animals and rodents. Temporary plugs shall be provided for this purpose. Keep all valves closed during construction.

42.19 RESTORATION OF DAMAGED SURFACES, STRUCTURES, AND PROPERTY

Where pavement, trees, shrubbery, fences, or other property and surface structures not designated as pay items have been damaged, removed, or disturbed by the CONTRACTOR, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, county or municipal ordinances, or the specific directions of the TOWN, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the CONTRACTOR to a condition equal to that before work began within a time frame approved by the TOWN.

42.20 RESTORATION AND CLEAN-UP

42.20.1 RESTORATION

1. General: Restoration of areas disturbed by the CONTRACTOR's operations shall begin as soon as practical. CONTRACTOR's restoration operations shall keep pace with utility installation. TOWN reserves the right to halt utility installation until restoration and clean-up requirements are satisfied.

2. Time Frame for Restoration: Restoration of areas disturbed by the CONTRACTOR's operations shall begin no later than 14 days and shall be completed (excluding punch list items) no later than 28 days from the time construction first began in the area. No more than 1,000 LF along the path of the work may be completely unrestored (excluding punch list items) at the end of each day.

42.20.2 CLEAN-UP

The CONTRACTOR shall maintain the site of the work in a neat condition. The CONTRACTOR shall remove all excess materials, excess excavated materials, and all debris resulting from his operations a minimum of once per week.

SECTION 43

WASTEWATER PUMP STATIONS

43.1 GENERAL

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

43.2 WETWELL

Wetwell shall be constructed as shown on the STANDARD DRAWINGS and in conformance with the specifications outlined in Section 41. All wetwells shall be watertight and have no leaks.

43.3 WETWELL LINER

All wastewater pump stations shall be provided with wetwell interior lining, as per one of the following:

43.3.1 FIBERGLASS LINER

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

43.3.2 HDPE LINER

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

43.3.3 EPOXY LINER

Epoxy coating shall be solvent-free 100 percent solids, ultra-high build epoxy coating specifically formulated for service in wastewater pump stations and manholes. The epoxy coating shall have broad range of chemical resistance, high physical strength and superior bond to concrete, steel, masonry, and fiberglass surfaces. The epoxy coating shall be designed for operating temperatures up to 200°F. The epoxy coating may

be spray-applied at the precaster's facility or at the site. Epoxy coating for wastewater pump stations shall be:

Green Monster: Product shall be Green Monster Liner by GML Coatings, LLC at 125 mils DFT. Applied per the manufacturer's recommendations by experienced applicators and shall be capable of passing a spark test.

Raven Lining Systems: Raven 405 as manufactured by Raven Lining Systems or approved equal. Epoxy coating shall be 80-mil thickness DFT. Applied per the manufacturer's recommendations by experienced applicators and shall be capable of passing a spark test.

43.4 PRECAST CONCRETE SECTIONS

43.4.1 Precast wetwells shall conform to specifications for ASTM C478 "Precast Reinforced Concrete Manhole Sections", except as otherwise specified below.

43.4.2 The minimum wall thickness shall be seven (7) inches. Precast wetwells shall be constructed with a precast monolithic base structure as shown on the Standard Drawings. The minimum base thickness shall be eight (8) inches.

43.4.3 Concrete shall be Type II, 4,000 psi at 28 days. All sections shall have tongue and groove joints except for top slab. All jointing material shall be a cold adhesive preformed plastic gasket, conforming to ASTM C443 "Manhole Section Connections".

43.4.4 The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each precast section.

43.4.5 Sections shall be cured by an approved method as per ASTM C478 for at least 28 days prior to coating and shall not be shipped until at least two (2) days after having been coated.

43.5 ACCESS FRAMES AND COVERS

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

43.6 PUMPS AND CONTROLS

Wastewater pumps shall be submersible type only. Submersible wastewater pumps and miscellaneous accessories shall be as specified in Section 44. Controls and miscellaneous accessories shall be as specified in Section 45.

43.7 PIPING, VALVES, AND ACCESSORIES

43.7.1 PIPING

Influent piping to the wetwell shall meet the requirements of Sections 40. All pipe inside the wetwell shall be 316 SS pipe and as shown on the STANDARD DRAWINGS. Aboveground piping outside the wetwell shall be 316 stainless steel or ductile iron. Ductile iron piping shall be lined with Protecto 401. Thickness of lining shall be 40 mil nominal thickness with no holidays and shall meet all requirements as specified in the Protecto 401 Ceramic Epoxy – Standard for Lining Ductile Iron Pipe and Fittings for Sewer Service.

43.7.2 PLUG VALVES

Plug valves shall meet the requirements of Section 42.

43.7.3 CHECK VALVES

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

When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

Check valves shall have bronze seat and body rings, extended bronze hinge pins and stainless steel nuts on the bolts of bolted covers.

Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. If pump shut off head exceeds 75 feet, then an air cushioned assembly shall be installed.

43.7.4 PRESSURE GAUGES

1. Pressure gauges shall be glycerin filled, 4-1/2" dial and black numerals on white background and fully compatible with pressure sensor. They shall have a 1/4" mounting and be provided with blowout protection.

    a. Provide stainless steel bourdon tube and movement and 316 stainless steel or noncorrosive case with safety glass lens and threaded lens retaining ring.

    b. Provide adjustable pointer with overpressure stop and zero pointer stop.

    c. Pressure gauge shall be accurate to + 1% of full range. Range shall be such that normal operating pressure is at midrange of scale.

d. Diaphragm protection seals and gauges shall be fitted at factory. Seals shall be removable for cleaning without disturbing the diaphragm.

e. Acceptable Manufacturers: Ashcroft, McDaniel, Ametek, General Instruments, Wika, or equal.

43.7.5 AIR RELEASE VALVES

All pump stations shall have an air release valve installed at the high point of the discharge piping center-line of the top. The minimum size shall be 2-inch. A stainless steel ball valve and nipple shall be provided. All air and vacuum combination release valves shall be Model ARI D-025SS, or approved equal.

43.8 STANDBY POWER GENERATOR SYSTEM

43.8.1 GENERAL

A standby power generator system shall be installed at pump stations as required by Section 22.4 for electrical power during the loss of normal power.

43.8.2 GENERATOR SET

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

   a. A complete engine generator system shall be furnished and installed with fuel transfer pump, fuel day tank, battery, battery charger, muffler, radiator, control panel, remotely mounted automatic transfer switch (part of the control panel), and all other accessories required for an operational system. 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.

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

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

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

3, Tests: Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to the TOWN.

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

b. Field tests shall include operating the diesel generating set for eight (8) hours, carrying normal lift station loads. The CONTRACTOR shall refill the main fuel tank at the completion of the tests.

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

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

The engine and generator shall be torsionally compatible to prevent damage to either engine or generator. An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges. A mechanically driven engine hour meter shall also be provided.

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

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

The excitation system shall employ a generator-mounted volts per hertz type regulator. Voltage regulation shall be plus/minus 2 percent

from no load to full load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus/minus 5 percent.

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

   a. Control Equipment: Control equipment shall consist of all necessary exciter control equipment, generator voltage regulators, voltage adjusting rheostat, and speed control equipment and automatic starting controls, as required to satisfactorily control the engine/generator set. In addition, an automatic safety shut down shall be provided for low oil pressure and/or high temperature conditions in the engine. An emergency shut down lever switch shall be provided on the air intake.

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

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

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

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

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

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

11. Utility Connections: All connections to the generator set shall be flexible.

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

13. Fuel System: An above ground, main fuel oil storage tank with float Switch and fuel level indication shall be furnished and installed by the CONTRACTOR. The emergency system shall include low fuel level contacts for remote alarm. If necessary to guard against loss of prime to pump, a check valve shall be mounted on pump intake. The emergency system shall include a float switch, fuel level gauge and standard control panel.

    Fuel oil piping, including mounting of any required fuel tanks, shall be furnished and installed by the CONTRACTOR.

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

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

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

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

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

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

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

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

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

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

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

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

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

16. Automatic Transfer Switch: The automatic transfer switch shall be part of the control panel described in Section 48.

The transfer switch shall be provided with the following features:

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

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

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

Time delay normal to emergency transfer - adjustable from zero second to 300 seconds (factory set at 1 second). The CONTRACTOR shall request time delay settings in accordance with the priority rating or their respective loads.

Time delay emergency to normal transfer - adjustable 30 seconds to 30 minutes (factory set at 5 minutes) and time delay bypass switch shall be provided on door of the switch cabinet.

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

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

43.9 FLOW MONITORING SYSTEM

43.9.1 GENERAL

When indicated on the DRAWINGS or as required by Section 22.3, a flow monitoring system capable of indicating, recording, and totalizing wastewater flows shall be provided. The system shall include magnetic flowmeter/transmitter, electronic recording receiver, and miscellaneous related accessories as specified herein. It shall be the CONTRACTOR's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system.

43.9.2 MAGNETIC FLOWMETER TRANSMITTERS

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

The metering tubes shall be constructed of stainless steel. All magnetic flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall consist of a flanged pipe spool piece with laying length of at least 1 1/2 times the meter diameter. Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flowmeter shall include both a magnet driver to power the magnet coils and a signal, converter. The signal converter shall be integrally mounted. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the electronics from the environment. A separate terminal strip for power connection shall be supplied. The electronics shall be of the solid state, feedback type and utilize integrated circuitry. The input span of the signal converter shall be continuously adjustable between 0-1 and 0-31 fps for both analog and frequency outputs. The converter shall not be affected by quadrature noise nor shall it require zero adjustment or special tools for start-up.

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

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

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

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

The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of

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

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

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

43.9.3 ELECTRONIC RECORDING RECEIVER

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

The instrument shall contain a differential amplifier, a TORQ-ER driving motor to position the pen, and a Flux Bridge contactless solid state position feedback device for balancing. The instrument shall be capable of receiving one process variable input. Inputs shall be provided with electrical isolation. The instrument shall accept an input signal of 4 to 20 mADC. Electrical zero and span adjustments shall be provided. Power requirements shall be 120 VAC± 10 percent, 60 Hz. A power supply shall be provided for two-wire transmitters. Accuracy shall be ±0.5 percent of span, with repeatability of ±0.2 percent of span.

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

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

43.9.4 WARRANTY AND SERVICE

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

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

43.10 CHAIN LINK FENCE

43.10.1 GENERAL

The CONTRACTOR shall furnish and erect the chain link fence and gate in accordance with these specifications and in conformity with the lines, grades,

notes, and typical sections shown on the DRAWINGS and the STANDARD DRAWINGS.

43.10.2 MATERIALS

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

1. The weight of coating of wire fabric shall be 1.2 ounces of zinc per square foot (Class B).

2. The galvanizing of steel materials shall be hot-dipped galvanized.

3. The weight of coating on posts and braces shall be 1.8 ounces of zinc per square foot, both inside and outside to meet the requirements of AASHTO M 111.

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

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

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

Miscellaneous fittings and hardware shall be zinc coated commercial quality or better steel or zinc coated cast or malleable iron as appropriate for the article.

Post caps, designed to provide a drive fit over the top of the tubular post to exclude moisture, shall be provided.

43.10.3 INSTALLATION

1. 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.

2. 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.

3. 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.

43.11 REQUIRED SUBMITTALS

43.11.1 Submittals shall be provided to the TOWN electronically and include the following:

1. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins, and/or catalogs of the equipment.

3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8 1/2) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.

4. Complete layouts, wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability will not be acceptable.

5. A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and in the panel shall be completely identified.

6. The weight of each pump.

7. Complete motor data shall be submitted including:
   - Nameplate identification
   - No-load current
   - Full load current
   - Pull load efficiency
   - Locked rotor current
   - High potential test data
   - Bearing Inspection report

43.12 ELECTRICAL GROUNDING SYSTEM

43.12.1 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. Wetwell Cover
2. Valve Vault Cover
3. Control Panels
4. Generator
5. Utility Company Transformer
6. Main Disconnect Switch
7. Fence

43.13 INSPECTION AND TESTING

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

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

1. That all units have been properly installed.

2. That the units operate without overheating or overloading any parts and without objectional vibration.

3. That there are no mechanical defects in any of the parts.

4. That the pumps can deliver the specified pressure and quantity.

5. That the pumps are capable of pumping the specified material.

6. That the pump controls perform satisfactorily.

SECTION 44

SUBMERSIBLE WASTEWATER PUMPS

44.1 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 of experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the DRAWINGS.

All parts shall be so designed and proportioned as to have liberal strength, and stiffness and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type 304 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. The nameplate rating of the motors shall not be exceeded.

The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3" diameter solid spheres. Pump operation shall be controlled automatically by means of float-type liquid level sensors in the wetwell. Pumps shall be mounted in the wetwell as shown on the DRAWINGS. (See approved manufacturer's list in Appendix A)

44.2 PUMP CONSTRUCTION DETAILS

44.2.1 SHAFT

The pump shaft shall be of Series 300 or 400 stainless steel. 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.

44.2.2 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.

44.2.3 MECHANICAL SEAL

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicon carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to openings and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

44.2.4 GUIDES

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts, Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) Type 316 seamless tubular stainless steel guides which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wetwell 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 wetwell. Each pump shall be fitted with a Type 304 stainless steel, 3/4" lifting chain of adequate strength. A 1/4" stainless steel cable, aircraft rating, shall be provided between the cable holder and the lifting chain.

44.3 MOTORS

44.3.1 GENERAL REQUIREMENTS

All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. Pump motors shall be housed in an air-filled, water-tight casing and shall have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, rated 155°C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non- submerged condition. The pump shall be capable of running continuously in a non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a

minimum of 10 starts per hour. If required by the TOWN, 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.

44.3.2 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.

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

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

44.4 PUMP CONTROL SYSTEM

Refer to Section 45 for control system specifications.

44.5 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 TOWN up to the time of the final acceptance test.

44.6 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.

44.7 WARRANTY

The pump manufacturer shall warrant the units being supplied to the TOWN against defects in workmanship and material for a period of one (1) year.

44.8 TOOLS AND SPARE PARTS

44.8.1 One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The manufacturer shall furnish the following spare parts for each size pump supplied:

1. 1 - upper bearing.
2. 1 - lower bearing.
3. 1 - set of upper and lower shaft seals.
4. 1 - set of “O-Rings” or gaskets required for replacement of bearings and seals.
5. 1 - set impeller wear ring.
6. 1 - shaft sleeve (if applicable).
7. 1 - cable cap (if applicable).

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long term storage under humid conditions. Spare parts and tools shall be delivered to the TOWN at or prior to the time of pump station start-up.

SECTION 45

PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

45.1 GENERAL

This section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years' experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. (See approved manufacturers' list in Appendix A) 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 wetwell 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 amperes, 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 wetwell liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

45.2 PANEL CONSTRUCTION

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

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head, KW input, and amps at the operating point and at least two other points on the pump curve. The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 3R listed.

45.3 POWER SUPPLY AND MAIN DISCONNECT

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

Non-fusible safety service main disconnects shall be installed at all stations. In all 240 volt systems, disconnects should be installed between the meter and the panel and on all 480 volt systems disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

45.4 CIRCUIT BREAKERS

45.4.1 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)

45.4.2 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)

45.5 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 overcenter 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 Protector 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.

45.6 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.

45.7 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.

45.8 LIGHTS AND ALARMS

45.8.1 INDICATOR LIGHTS

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

45.8.2 HIGH LEVEL ALARM

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

45.9 EMERGENCY POWER RECEPTACLE

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

45.10 ADDITIONAL REQUIREMENTS

45.10.1 WIRING

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

45.10.2 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.

45.10.3 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.

45.10.4 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 manufacturers' specifications, surge protectors shall be attached to the main disconnects.

45.10.5 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.

45.10.6 CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120volt, 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.

45.10.7 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.

45.10.8 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.

45.10.9 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.

45.10.10 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 TOWN personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

45.10.11 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.

45.11 TESTING, SERVICE AND WARRANTY

45.11.1 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.

45.11.2 SERVICE

The control panel manufacturer shall maintain a service organization within 150 miles of the TOWN.

45.11.3 WARRANTY

The manufacturer shall furnish a five (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section.

DIVISION V
WATER DISTRIBUTION SYSTEMS

SECTION 50

WATER DISTRIBUTION SYSTEMS

50.1 GENERAL

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

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

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the TOWN, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

50.2 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The work under this Contract shall be in strict accordance with the following codes and standards.

1. All local, county, municipal, and federal codes.
2. American National Standards Institute (ANSI).
3. American Society for Testing and Materials (ASTM).
4. American Water Works Association (AWWA).
5. American Association of State Highway and Transportation Officials (AASHTO).
6. Florida Department of Transportation Specifications (DOT).
7. Recommended Standards for Water Works, 10-States Standards.
8. Florida Dept. of Environmental Protection

50.3 QUALITY ASSURANCE STANDARDS

50.3.1 American National Standards Institute, Inc. (ANSI)/American Water Works Association (AWWA):

1. ANSI/AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105, Polyethylene Encasement for Ductile - Iron Piping for Water and Other Liquids.

3. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

4. ANSI/AWWA C115, Flanged Ductile-Iron Pipe with Threaded Flanges.

5. ANSI/AWWA C150, Thickness Design of Ductile-Iron Pipe.

6. ANSI/AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

7. ANSI/AWWA C153, Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids.

8. AWWA C502, Dry-Barrel Fire Hydrants.

9. AWWA C504, Rubber-Seated Butterfly Valves.

10. AWWA C515, Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.

11. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

12. AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

13. AWWA C651, Disinfecting Water Mains.

14. AWWA C701, Cold-Water Meters - Turbine Type, for Customer Service.

15. AWWA C800, Underground Service Line Valves and Fittings.

16. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution.

17. AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. through 48 In. for Water Transmission and Distribution.

50.3.2 American Society for Testing and Materials (ASTM):

1. D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

2. D-2464, Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fillings, Schedule 80.

3. D2467, Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

4. D2564, Solvent Chemicals for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

5. D2855, Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

50.3.3 Manufacturer's name and model numbers are listed to establish a standard of quality. Equivalent items of other manufacturers are acceptable.

50.4 SUBMITTALS

50.4.1 Submit manufacturer's certification of materials' conformance to specifications.

50.4.2 Submit manufacturer's literature, catalog data and installation instructions.

50.4.3 Submit certified field pressure test reports.

50.5 PRODUCT DELIVERY AND HANDLING

50.5.1 Exercise care to prevent damage of product during loading, transporting, unloading and storage.

50.5.2 Do NOT drop pipe or fittings.

50.5.3 Do not store directly on ground and assure that materials are kept clean. Pipe shall be kept bundled and strapped until it is ready for installation in order to prevent warping or disfiguring.

50.5.4 Store material in areas approved by the Owner.

50.5.5 Store material in such a manner as to not create a nuisance or safety hazard.

50.6 PIPE

50.6.1 General: Pipe shall be furnished free from defects impairing strength and durability and should be of best commercial quality for purpose specified. Structural properties shall be sufficient to safely sustain or withstand strains to which it is normally subjected. All pipe shall bear the National Sanitation Foundation Seal for potable water pipe.

50.6.2 Pipe Materials

1. Ductile Iron (D.I.) ANSI/AWWA C151:

    a. Metal Thickness, ANSI/AWWA C150:

        1) 3 Inch through 12 Inch: Pressure Class 350.
        2) 14 Inch and Larger: Pressure Class 250.
        3) Jack and Bore Crossings: Pressure Class 350.

    b. Interior Lining, ANSI/AWWA C104: mortar lined.

    c. Exterior Coating, Bituminous Coating, 1 Mil thick.

2. Polyvinyl Chloride (PVC) 14 In. and larger:

   a. Specification: AWWA C905.

   b. Compound: PVC 12454-B, ASTM D 1784.

   c. Thickness: Class 165, DR 25.

3. Polyvinyl Chloride (PVC) 4 In. Through 12 In.:

   a. Specification: AWWA C900.

   b. Compound: PVC 12454-B, ASTM D 1784.

   c. Thickness: Class 150, DR 18.

4. Polyvinyl Chloride (PVC), 3 In. and Smaller:

   a. Specification: ASTM D1785.

   b. Compound: PVC 12454-B, ASTM D1784.

   c. Thickness: Schedule 80.

50.6.3 Pipe Joints

1. Ductile Iron:

   a. Mechanical: ANSI/AWWA C111.

   b. Push On: ANSI/AWWA C111, single gasket type.

   c. Flanged: ANSI B16.1, 125 lb.

   d. Restrained: Acceptable: Lock-Fast, American Ductile Iron Pipe; TR Flex, U.S. Pipe; Super-Lock, Clow Corporation; Megalug 1100 and 1700 Series.

2. Polyvinyl Chloride,4 In. and Larger:

   a. Push On: ASTM F477 Elastomeric Gaskets

   b. Restrained: UNI-BELL B-13, Uni-Flange Restrainer; Megalug 2000 PV and 1600 Series.

3. Polyvinyl Chloride, 3 In. and Smaller:

   a. Screwed: ASTM D2464.

   b. Solvent Weld: ASTM D2855.

   c. Solvent: ASTM D2564.

50.6.4 Pipe Fittings

1. Ductile Iron and Polyvinyl Chloride (PVC) 3 In. and Larger:

    a. ANSI/AWWA C153, ductile iron compact fittings.

    b. ANSI/AWWA C104, mortar lined.

    c. Mechanical: ANSI/AWWA C111.

    d. Push On: AWSI/AWWA C111.

    e. Flanged: ANSI B16.1, 125 lb.

    f. Restrained-Ductile Iron: Same as Ductile Iron Pipe Joints.

    g. Restrained-PVC: Same as PVC Pipe Joints.

2. Polyvinyl Chloride (PVC) 3 In. and Smaller:

    a. ASTM D2464, Schedule 80 PVC threaded fittings.

    b. ASTM D2467, Schedule 80 PVC socket type fittings.

    c. ASTM D2855, solvent weld joints.

50.6.5 Pipe Marking and Identification

1. Ductile Iron Pipe: Permanent marking tape, with the words “WATER MAIN” printed along the tape, shall be attached to the pipe for its entire length. In addition, similar marking tape shall be placed in the trench over the pipe, six to twelve inches below finished grade, of the entire length of pipe.

2. PVC Pipe:

    a. All non-metallic water main pipe installed underground shall have a #12 gauge, solid strand, copper type UF insulation trace wire (blue in color) attached for locating purposes. Half hitches shall be made behind each pipe bell and on each side of a valve or fitting. Branch splices shall be made at all tees, fire hydrants, and service lines. Trace wire shall be run into valve boxes. Watertight splicing connectors shall be utilized for all splices. Contractor shall be responsible for continuity of trace wire between valve boxes.

    b. All PVC water main pipe shall be manufacturer’s standard blue color or shall have permanent marking tape attached with the words “WATER MAIN” printed along the tape. In addition, similar marking tape shall be placed in the trench over the pipe, six to twelve inches below finish grade, for the entire length of pipe.

3. Above-ground Piping Coatings: Non-Submerged Ferrous Metals (Includes all exposed piping, valves, fittings, and supports which are not aluminum, galvanized or stainless steel).

   a. Surface Preparation: Degrease before proceeding. SSPC-SP-10 Near-White Blast Cleaning. Coat all steel before any rust bloom forms. The surface should be dry and free of any contamination. Consult the manufactures application instructions for the recommended Blast profile.

   b. Primer: High-build polyamide epoxy primer applied at 6.0 mils DFT. Use Sherwin-Williams Macropoxy 646 Fast Cure Epoxy, or equal.

   c. Finish: Polyurethane applied at 4.0 mils. Use Sherwin-Williams Acrolon 218 HS Acrylic Polyurethane, or equal.

   Minimum system dry film thickness 10.0 mils. All colors shall be in accordance with 10 State Standards as approved by the Owner. All piping shall be labeled in accordance with the 10 State Standard requirements, and flow arrows shall be provided. Stenciling shall be accomplished through painting or vinyl tape. All lettering shall be two inches high, appear on both sides of pipes, and be spaced on 10-foot intervals.

50.7 GATE VALVES

50.7.1 Two Inch and Larger: Shall be AWWA C515, iron body, resilient wedge, resilient seat, non-rising bronze stem with 2" square operating nut on buried valves, turn to left (counter clockwise) to open.

1. Working pressure of 200 psi.

2. Internal Metal Surfaces shall have two-part thermosetting epoxy coating, 4 mils thick.

3. Sealing Mechanism shall have zero leakage at 200 psi with flow in either direction.

4. End Conditions:

   a. Above ground, ≥ 2-inch: Flanged Joint
   b. Below ground, ≥ 3-inch: Mechanical Joint
   c. Below ground, ≤ 2-1/2-inch: Threaded Joint

5. Acceptable: Mueller, American, or equal.

50.7.2 Two Inch and Smaller:

1. Type III (double wedge disc, rising stem, inside screw).

2. Class B (150 lb. steam rating).

3. Threaded ends.

50.8 VALVE BOXES

1. Provide at all manually operated valves installed on underground lines.

2. ASTM A48, cast iron, Class 30-B, 3-piece extension type, with cover marked "WATER" and flared base to suit valve furnished.

3. Acceptable: Figure No. F-2450, Clow Corporation; Catalog No. H10357, Mueller Co.; Figure No. E-3002, M & H Valve and Fittings Co. or equal.

50.9 FIRE HYDRANTS

A. AWWA C502 Dry-Barrel type fire hydrant with 5 ¼" main valve.

B. Working Pressure Rating 150 psi.

C. Provided with two 2 ½ Inch hose connections and one 4 ½ In. hose connection.

D. Acceptable: American Darling B-62-B; Clow Medallion Hydrant, Mueller BSR 5 ¼" or equal.

50.10 FLUSHING VALVE

A. Blow offs shall be box hydrants with a 2" main valve and a 2" bronze, male, thread discharge nozzle.

B. All hydrants shall have lockable iron lids, all bronze working parts and removable bronze seats with rubber seals.

C. One 24"-long operating wrench shall be provided for every three hydrants furnished.

D. Acceptable: Kupferle Foundry, Model 85B; H20K, Inc., the Sample Station; or equal.

50.11 AIR RELEASE VALVES

All potable water lines shall have air and vacuum release valves installed as they are indicated on the plans. The body/base of these valves shall be made from high strength lightweight non-corroding fiberglass reinforced nylon, with total weight of no more than three (3) pounds, and all operating parts are to be made of engineered corrosion resistance plastic materials. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and shall have a 3/4-inch, 1-inch, 2-inch threaded connection, or 3-inch and 4- inch flange connection. All air and vacuum release valves shall be Model ARI D-040, D-040C or approved equal. The connection to the system shall be a direct threaded connection, or flange, on the top of the pipe with a saddle, with an isolation valve. The height of valve shall not be more that 9-inches. If room does not allow for a direct connection, the use of a 90 degree bend can be used of offset the connection to the side. This connection must have a grade that increases as it leaves the connection at the pipe. All ARV valves must be ISO-9000 and NSF 61 certified.

All potable water lines that require automatic air release only, shall have as shown on the plans a 1/2-inch, 3/4-inch, or 1-inch threaded air release valve. This valve shall be made from lightweight non-corroding fiberglass reinforced nylon plastic, with a total weight of no more than one (1) pound, with all non-metallic operating parts. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and tested to 350 psi. All air release valves shall be Model ARI S-050 or approved equal. The connection to the system shall be a direct connection to the pipeline with the use of a saddle and an isolation valve. All ARV valves must be ISO-9000 certified, and those valves for potable water applications must have NSF 61 certification.

50.12 TAPPING SADDLE

All tapping saddles shall be suitable for the size and type of pipe being tapped. Saddle for pipe 4-inch and larger shall be brass with stainless steel double band and bolts. Acceptable: Ford 202BS or equal. Saddles for pipe less than 4-inch diameter shall be Ford S70 or 202B, as required, or equal.

50.13 CORPORATION STOPS

Corporation Stops shall be Mueller, Hayes or Ford threaded on the inlet side with Mueller threads and the outlet side fitted with connections to suit the connecting pipe.

50.14 CURB STOPS

50.14.1 Curb stops shall be Mueller, Hayes or Ford.

50.14.2 All curb stops shall have a locking wing.

50.15 METER COUPLINGS

50.15.1 Meter Couplings shall be Mueller, Hayes or Ford.

50.15.2 Couplings shall be straight meter couplings with M.I.P.T.

50.16 SERVICE PIPE

50.16.1 Service piping shall be polyethylene, SDR 9, AWWA C901, ASTM D2737, PE 3408, colored blue, NSF Seal, with Type 316 stainless steel inserts.

50.17 WATER METERS

Water meters shall be furnished by the TOWN for CONTRACTOR to install.

50.18 METER BOXES

50.18.1 Water Meter Boxes shall be plastic or polymer material with an in-ground base and a removable cast iron cover. The overall size of the box shall accommodate the size of the water meter and the curb stop with additional space at each end of the box.

50.18.2 Boxes located within traffic-loaded areas shall be suitable for wheel loads.

50.18.3 Acceptable: DFW Plastics, Inc. (Model DFW 1200)

50.19 PLASTIC LOCATING AND MARKING TAPE

Tape shall be plastic coated foil with a minimum width of 2 inches. Tape shall be highly visible and shall have the words "WATER MAIN" in at least 1" letters printed at least every 36 inches along the tape. Tape shall be located one foot below ground surface directly above the centerline of the pipe. Tape shall be Allen Marking Tape or equal.

50.20 LOCATE WIRING

Locate wire shall be installed on all PVC, ductile iron and HDPE water main piping, and services 10 LF or greater in length. No wire shall be installed on above ground installations (must meet minimum installation requirements, see details). Locate wiring for direct bury shall be 12 gauge, copper wire with 0.03 inches (minimum) HDPE insulation thickness, 0.141 inches (minimum) O.D. rated break load 250 lbs., 30 volt, 21% IACS. The outside color of the wire shall be blue. Copperhead and Protrace tracer wire or approved equal.

50.21 PIPE COUPLINGS

The Contractor shall furnish and install pipe couplings as required to complete the work. Pipe couplings used to join two pieces of ductile iron pipe or PVC pipe shall be sized to match the outside diameter of the pipeline. Transition couplings shall be used to join pipes of different outside diameters. The coupling sleeve shall be manufactured of ductile iron conforming to ASTM A536 and be coated with 14 mils of epoxy. The bolts shall be manufactured of a metal of high corrosion resistance and shall conform to ANSI 21.11 (AWWA C111). Gaskets shall be wedge-type and manufactured of virgin SBR for water and sewer service. The installation of all couplings shall be in accordance with latest manufacturer's recommendations. Unless approved otherwise by the Engineer, the maximum gap between pipe ends shall be: (based upon sleeve length) 5" sleeve, 1" gap; 7" sleeve, 2" gap, 10" sleeve, 3-1/2" gap; other per manufacturer's recommendation. Couplers and adapters for polyethylene pipe shall be brass confirming to AWWA C800 and shall be female IPS, pack joint or compression nut.

50.22 EXCAVATION

50.22.1 GENERAL

The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the Drawings or as necessary. This shall include all necessary clearing and grubbing of any foreign substance encountered within the structure or trench area. Excavated material suitable for backfill shall be piled in an orderly manner at a sufficient distance from the trench to prevent slides or cave-ins.

50.22.2 PROTECTION OF EXISTING FACILITIES AND UTILITIES

All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury and, in case of damage, they shall be restored, pressure tested and disinfected by the Contractor without compensation. Existing utilities and other underground obstructions are shown on the plans, but the accuracy of the locations and depths is not guaranteed. The Contractor shall contact all utilities prior to construction and arrange for the necessary assistance in locating and protecting

the existing utilities. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition.

50.22.3 TRENCH EXCAVATION

Shall be in accordance with the Florida Trench Safety Act. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 in. each side of pipe for unsheeted or sheeted trench, with the maximum width of trench, measured at the top of the pipe, not to exceed the outside pipe diameter, plus 24 in., unless otherwise shown on the Drawings. Trench walls shall be maintained vertical from the bottom of the trench to a line measured at the top of the pipe. From the top of the pipe to the surface of the trench walls shall be as vertical as possible under soil conditions.

No more than 300 linear feet of trench shall be open in advance of the completed pipe laying operation without prior approval of the Engineer. Pipe trenches across roadways and driveways shall be backfilled as soon as the pipe is installed. Where, in the opinion of the Engineer, adequate detour facilities are not available, no trench shall be left open across a roadway or commercial property driveway where adequate detour routes are not available for a period in excess of 30 minutes, or as directed by the governing authority. No trench shall be left open across any roadway or driveway for more than 24 hours. It shall be the Contractor's responsibility to provide traffic control and barricades as necessary.

50.22.4 SHORING, SHEETING AND BRACING

The Contractor shall do all shoring, sheeting and bracing or provide other approved facilities required to perform and protect the excavation and as necessary for the safety of the public, the employees, and the preservation of existing roads, structures and other utilities. The top of such sheeting left in place shall be cut off at a minimum elevation of 2.5 ft. below finished grade.

50.22.5 PAVEMENT REMOVAL

The Contractor shall remove pavements as part of the trench excavation. The material from permanent pavement removal shall be carefully separated from trench excavation material and disposed of by the Contractor.

50.22.6 BOULDER REMOVAL

All rocks, stones, boulders or concrete, having any dimension larger than permitted to be used for backfill in the paragraph entitled "Backfilling" of these Specifications, shall be removed from the site and disposed of by the Contractor.

50.22.7 UNSUITABLE SOIL CONDITIONS AND OVERDEPTH EXCAVATION

Where determined by Engineer or his representative that the soils encountered in the utility trench excavation are unsuitable for pipe bedding and/or backfill, the depth of excavation shall be increased as directed by Engineer or his representative. The bottom of the excavation shall be brought up to the proper

excavation elevation utilizing suitable and properly-compacted backfill material or bedding material as directed by the Engineer or his representative. Bedding material if required, shall consist of ½" to 1" diameter gravel placed in bottom of trench at a thickness of 4 to 6 inches. Suitable backfill material shall then be installed and compacted over pipe as described in Paragraph 3.04. Contractor shall be compensated for removal and replacement of unsuitable soils in accordance with the applicable bid items.

50.22.8 DISPOSAL OF EXCESS MATERIAL

The Contractor shall dispose of the excavated materials not required or suitable for backfill. All surplus excavated material which is unsuitable for fill shall become the property of the Contractor and shall be disposed of by the Contractor at his expense. Pieces of broken asphalt shall be carefully separated from suitable fill material and hauled to an asphalt plant for disposal or shall be disposed of by some other acceptable means by the Contractor at no expense to Owner. All excavated material not suitable for backfill (e.g., concrete, boulders, roots, etc.) shall be carefully separated from suitable fill material and disposed of by the Contractor at no expense to Owner. Owner has the option to accept suitable backfill material from the Contractor.

50.23 INSTALLATION OF WATER MAINS AND SERVICES

50.23.1 GENERAL

Unless otherwise noted on the Drawings or in other sections of this Specification, the pipe shall be handled and installed in strict accordance with the manufacturer's instructions and with the applicable AWWA or ASTM Standards.

1. Ductile Iron Pipe: AWWA C-600.

2. Polyvinyl Chloride Pipe: ASCE Manual No. 37, ASTM D2321.

3. If a conflict exists between the manufacturer's instructions and the AWWA or ASTM Standards, the manufacturer's instructions shall govern.

4. Examine area to receive pipe work for defects that adversely affect execution of work or cause deviation beyond allowable tolerances for piping clearances.

5. Carefully examine each section of pipe or valve before installation. Do not use defective or damaged pipe or materials. Remove such pipe or material from project site immediately.

50.23.2 PREPARATION

The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals and other foreign material that would hinder the operation of the pipeline. All valves installed in main shall be kept tightly closed until flushing and testing are to be performed. Where the groundwater elevation is above the bottom of the trench,

the Contractor shall provide suitable dewatering equipment. All piping shall be placed in a dry trench, unless wet trench installation is approved by the Engineer.

50.23.2 DEPTH OF COVER

Unless otherwise shown on the Drawings, or otherwise authorized by the Engineer, the pipe shall have a minimum cover of 36 inches.

50.23.3 CONNECTIONS TO EXISTING MAINS

The Contractor shall make connections to existing mains as shown on the Drawings. Connections shall be made only after arrangements have been completed by the Contractor with the Owner of the system and shall be under the System Owner's immediate supervision. Contractor shall be required to restrain existing pipe as necessary in accordance with pipe restraint schedule.

50.23.5 PIPE THRUST RESTRAINTS

Mechanical restrainers shall be installed as required to properly restrain all piping systems. At a minimum, restrainers shall be provided on all below-grade valves and fittings and at the required number of pipe joints in each direction. Required lengths of restrained pipe shall be as shown in pipe restraint schedule at end of this paragraph for the type of soil encountered. For above-grade piping, all valves and fittings shall be threaded, flanged or solvent welded with supports as required.

PIPE RESTRAINT SCHEDULE

MINIMUM LENGTH OF PIPE (IN FEET) REQUIRED TO BE RESTRAINED ON EACH SIDE OF A VALVE OR FITTING FOR SANDY SOILS (SW, SP, SM, SC)

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
PVC PIPE	<4	18	18	18	18	18	22	36	18	52
	6	24	18	18	18	18	30	38	36	73
	8	31	18	18	18	18	40	69	36	96
	10	37	18	18	18	18	48	93	54	115
	12	43	18	18	18	18	56	99	54	136
	14	49	20	18	18	18	64	101	72	155
	16	55	23	18	18	18	72	103	72	174
	18	60	25	18	36	20	80	104	72	192
	20	65	27	18	36	21	87	105	72	211
	24	75	31	18	36	25	102	134	90	246
	30	88	37	18	36	29	122	185	90	295

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
DUCTILE IRON	≤4	18	18	18	18	18	18	18	18	33
	6	20	18	18	18	18	19	35	36	47
	8	26	18	18	18	18	25	44	36	61
	10	31	18	18	18	18	30	60	54	73
	12	37	18	18	18	18	36	63	54	86
	14	41	18	18	18	18	41	64	72	98
	16	46	19	18	36	18	46	66	72	111
	18	51	21	18	36	18	51	66	72	122
	20	56	23	18	36	18	56	67	72	134
	24	64	27	18	36	21	65	85	90	156
	30	75	31	18	36	25	78	118	90	188

PIPE RESTRAINT SCHEDULE

MINIMUM LENGTH OF PIPE (IN FEET) REQUIRED TO BE RESTRAINED ON EACH SIDE OF A VALVE OR FITTING FOR CLAYEY AND SILTY SOILS (CL, CH, ML, MH)

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIGH			
PVC PIPE	≤4	19	18	18	18	18	23	36	18	55
	6	26	18	18	18	18	32	40	36	77
	8	35	18	18	18	18	42	73	36	101
	10	42	18	18	18	18	50	98	54	121
	12	50	21	18	18	18	59	104	54	143
	14	57	23	18	36	20	67	106	72	163
	16	64	27	18	36	23	76	109	72	183
	18	71	29	18	36	25	84	109	72	202
	20	78	32	18	36	28	92	110	72	221
	24	92	38	18	36	33	107	140	90	258
	30	110	46	22	54	40	127	193	90	308

PIPE TYPE	PIPE SIZE	90° BEND	45° BEND	≤22.5° BEND	TEE OR CROSS	VERTICAL OFFSET[a]		REDUCER[b]	VALVE	DEAD END
						LOW	HIG			
DUCTILE IRON	≤4	18	18	18	18	18	18	18	18	35
	6	22	18	18	18	18	20	25	36	49
	8	29	18	18	18	18	27	46	36	64
	10	35	18	18	18	18	32	62	54	77
	12	41	18	18	18	18	37	66	54	90
	14	47	20	18	18	18	43	67	72	103
	16	53	22	18	36	19	48	68	72	115
	18	59	24	18	36	21	53	69	72	127
	20	65	27	18	36	23	58	70	72	140
	24	76	31	18	36	27	67	89	90	162
	30	91	38	18	36	32	80	122	90	194

Assumptions: 1. Pipe Test Pressure = 150 PSI
2. Minimum Pipe Depth = 3.0 Feet
3. Laying Condition = Type 5
4. Safety Factor = 2.0

a "Low" represents the minimum length of pipe (in feet) required to be restrained on the low side of the vertical offset, which is typically downstream of the offset fitting. "High" represents the minimum length of pipe (in feet) required to be restrained on the high side of the vertical offset, which is typically upstream of the offset fitting. Required restrained lengths assume an offset angle ≤ 45°.

b Distance represents the linear feet of large diameter pipe upstream of the reducer required to be restrained. Restrain small diameter pipe at reducer at a minimum. If there is an unobstructed run downstream of the reducer (i.e. small diameter pipe) of at least 2.5 times the required length of large diameter pipe to be restrained, then restraint is required only at the reducer fitting. If small end of reducer is more than three pipe sizes smaller than large end, consult Engineer for required length to be restrained.

50.24 WATER AND SEWER LINE ORIENTATION

50.24.1 HORIZONTAL SEPARATION

1. New or relocated, underground water mains shall be laid to provide a horizontal distance of at least three feet between the outside of the water main and the outside of any existing or proposed storm sewer, stormwater force main, or pipeline conveying reclaimed water.

2. New or relocated, underground water mains shall be laid to provide a horizontal distance of at least six feet, and preferably ten feet, between the outside of the water main and the outside of any existing or proposed gravity- or pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. The minimum horizontal separation distance between water mains and gravity-type sanitary sewers shall be reduced to three feet where the bottom of the water main is laid at least six inches above the top of the sewer.

50.24.2 VERTICAL SEPARATION

1. New or relocated, underground water mains crossing any existing or proposed gravity- or vacuum-type sanitary sewer or storm sewer shall be laid so the outside of the water main is at least six inches, and preferably 12 inches, above or at least 12 inches below the outside of the other pipeline. However, it is preferable to lay the water main above the other pipeline.

2. New or relocated, underground water mains crossing any existing or proposed pressure-type sanitary sewer, wastewater or stormwater force main, or pipeline conveying reclaimed water shall be laid so the outside of the water main is at least 12 inches above or below the outside of the

other pipeline. However, it is preferable to lay the water main above the other pipeline.

3. At the utility crossings described in paragraphs B.1. and B.2. above, one full length of water main pipe shall be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline. Alternatively, at such crossings, the pipes shall be arranged so that all water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, stormwater force mains, or pipelines conveying reclaimed water, and at least six feet from all joints in gravity- or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

50.24.3 ALTERNATE SEPARATION

1. Where an underground water main is being laid less than the required minimum horizontal distance from another pipeline and where an underground water main is crossing another pipeline and joints in the water main are being located less than the required minimum distance from joints in the other pipeline, equivalent separation can be achieved by:

    a. Use of pressure-rated pipe conforming to the American Water Works Association standards C-900 or C-905 for the other pipeline if it is a gravity- or vacuum-type pipeline;

    b. Use of welded, fused, or otherwise restrained joints for either the water main or the other pipeline; or

    c. Use of watertight casing pipe or concrete encasement at least six inches thick for either the water main or the other pipeline.

2. Where an underground water main is being laid less than three feet horizontally from another pipeline and where an underground water main is crossing another pipeline and is being laid less than the required minimum vertical distance from the other pipeline, equivalent separation can be achieved by:

    a. Use of ductile iron carrier or casing pipe, or concrete encasement at least four inches thick for the water main; and

    b. Use of ductile iron carrier or casing pipe, or concrete encasement at least four inches thick for the other pipeline if it is new and is conveying wastewater or reclaimed water.

50.24.5 CONCRETE ENCASEMENT OF PIPE

Where concrete encasement of pipe is required for obtaining separation from other pipes or for other reasons (e.g., inadequate cover), the pipe shall be encased with 3,000 psi concrete having a minimum thickness of 6 inches all around the outside of the pipe. Pipe must be supported in trench to allow 6 inches of concrete on all sides. Concrete must be mechanically vibrated into place. The Engineer or his representative must be present at the time of encasement.

50.25 BACKFILLING

50.25.1 MATERIAL

All backfill shall be excavated material, essentially free of organic material, asphaltic concrete, clay, concrete, boulders and other deleterious material.

1. Bedding and Pipe Embedment: The material in the bedding, around the pipe and to a depth of 1 ft. over the pipe, shall be sand or a mixture of sand, shell or crushed stone properly graded and mixed so that fine grain material from the side walls of the trench or backfill above the embedment will not migrate into the backfill material. The backfill shall meet the following limitations.

    a. Ductile Iron Pipe: All material shall pass through a 3/4 in. square opening laboratory sieve.

    b. Plastic Pipe: All materials shall pass through a ½ in. square opening laboratory sieve.

2. Above Pipe Embedment: The material shall be sand or a mixture of sandy material with rock, stone and shell. Rock, stone, and shell shall pass through a 3-1/2 inch ring.

3. Top of Backfill: The top 12 inches of the backfill shall be topsoil and/or sandy material.

4. Additional Fill: If sufficient suitable backfill material is not available from the excavation, additional fill meeting the above requirements shall be provided by the Contractor.

50.25.2 PLACING AND COMPACTION

1. Under Pavement: Where the excavation is made through existing or proposed pavements, including shoulders, curbs, driveways, sidewalks, or structures, the entire backfill to the subgrade of the pavement or structures shall be made with predominantly sandy material free from rock, stones or organic matter, except that rocks passing a 3-1/2 inch ring will be permitted in the backfill between the elevation one foot above the top of the pipe and the bottom of the pavement subgrade.

    The entire backfill material, including the material placed around and one foot above the pipe, shall be compacted to a density of not less than 98% of the maximum density, as determined by AASHTO T-180. Particular care shall be taken to ensure that the backfill at the haunch is free from voids and is properly compacted. Compaction by flooding or puddling will be permitted only by written authorization from the Engineer.

    Roads, walks and driveways consisting of broken stone, gravel, clay, marl, shell, shellrock, or a conglomerate of such materials, are not considered as being permanent pavement.

2. In Areas Not Under Permanent Pavement: Within rights-of-way or other areas where permanent pavement does not exist or is not proposed, including roads, walks and driveways consisting of broken stone, gravel, clay, marl, shell, shellrock or conglomerate, the entire backfill to the subgrade of the pavement or structures shall be made with predominantly sandy material free from rock, stones or organic matter, except that rocks having a maximum dimension of 3 ½ inch will be permitted in the backfill between the elevation 1 ft. above the top of the pipe and 1 ft. below the surface. Particular care shall be taken to ensure that the backfill at the haunch is free from voids and is properly compacted. The bedding and embedment shall be compacted to a density of not less than 98 percent of maximum as determined by AASHTO T-180. The backfill material above 1 ft over the pipe shall be compacted to a density of not less than 90 percent of the maximum density, as determined by AASHTO T-180. Compaction by flooding or puddling will be permitted only by written authorization from the Engineer.

   In areas where unpaved, stabilized roads exist, the CONTRACTOR shall restore the road to its original grade and condition. The finished stabilized road shall have a minimum LBR value of 40 for the top 12" of the roadbed.

3. Miscellaneous: Backfilling around meter boxes, valve boxes and other structures shall be accomplished in the same manner as the connected pipe. Extreme care shall be used in backfilling wellpoint holes to prevent voids and settlement. If necessary, the holes should be plugged with a concrete slurry, such plugging to be at the expense of the CONTRACTOR.

4. Compaction Tests: The TOWN or its representative may at any time instruct the CONTRACTOR to partially excavate a previously backfilled trench or temporarily backfill a short section of the trench for the purpose of obtaining measurements of the density of the backfill. All density tests shall be paid for by the Contractor. Density tests shall be taken along the pipe a minimum of every 300 feet, at each road lane crossing, and as directed by Engineer. Density tests shall be taken in one-foot lifts from bottom of trench to finished grade.

50.26 CULVERT REMOVAL AND REPLACEMENT

50.26.1 Culverts, catch basins and other drainage structures that are removed or damaged during construction shall be replaced with materials and structures equal and similar to those removed or damaged. Manhole covers and gratings shall be set at the original elevations unless otherwise directed.

50.26.2 The CONTRACTOR shall take precautions against the entry of excavated and other loose material resulting from his operations from entering catch basins, culverts, and other drainage structures in the vicinity of his operations. He shall maintain the cleanliness of these drainage structures in a condition equal to that prior to the commencement of his operations during the construction. The CONTRACTOR shall be responsible for all damage to persons, roads, buildings, vehicles, and other property resulting from the failure of the CONTRACTOR to maintain these drainage structures.

50.27 TESTING AND DISINFECTION

50.27.1 FLUSHING OF COMPLETED PIPELINES

Each section of completed pipeline shall be thoroughly flushed. A minimum flow shall be used for flushing that will ensure a velocity in the pipe of 2.5 ft. per second. Water required for testing and flushing will be furnished by the TOWN at existing pipes and outlets. CONTRACTOR shall slowly fill system to eliminate air pockets, then flushed to remove particulates. Flushing shall comply with Figures 1 and 2, and Table 3 of AWWA C651. Provide corporation stops at any high points in line in order to bleed air from pipe. CONTRACTOR shall make provisions to properly dispose of water from his flushing operations. Flooding of streets and private property shall not be permitted. CONTRACTROR shall arrange with TOWN 72 hours in advance of the time of flushing for the availability of water. Water required for testing and flushing will be furnished by the TOWN from a potable water source satisfactory to the TOWN and shall be properly metered and paid for by the CONTRACTOR.

50.27.2 LEAKAGE TEST

Leakage and pressure tests shall be conducted in the presence of the TOWN. The CONTRACTOR shall provide all necessary apparatus including a pump, flow measuring device, piping connections and fittings and the necessary labor to conduct the tests. The test shall be of not less than two (2) hours in duration. During the test, the pipe being tested shall be maintained at a pressure of not less than 150 psi. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage shown by test. Lines which fail to pass tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves, and accessories shall be removed and replaced. The pipe lines shall be tested in sections between every consecutive in-line valve unless otherwise directed by the TOWN *with all water services connected to the curb stop*. The line shall be filled with water and all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided by the Contractor for measuring the makeup water required to maintain this pressure. Leakage is defined as the quantity of makeup water added to the pipe being tested during the test period. No pipe installation will be accepted if the leakage exceeds the quantities specified in AWWA C605-05, which is represented by the following equation.

Where:
Q = Quantity of makeup water (allowed) in gallons per hour
L = Length of pipe section being tested, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge)

50.27.3 TESTING PLAN

The CONTRACTOR must review his plan for testing with the TOWN at least two (2) working days before starting the test. The CONTRACTOR shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the Engineer. Any damage to the pipe coating shall be repaired by the CONTRACTOR. Lines shall be totally free of debris prior to final acceptance.

50.27.4 DISINFECTION

The disinfection of water main piping shall be conducted in accordance with AWWA C651 using the continuous-feed method and shall be performed by specialty trained personnel. The new water piping shall be kept isolated from the existing distribution system using a physical separation (Figure 1 of AWWA C651) until satisfactory bacteriological testing has been completed. Provide all temporary filling, flushing and testing connections (complying with Figures 1 and 2 of AWWA C651), potable water, chemicals, sampling and bacteriological test results. The continuous-feed method shall include slowly and completely filling the main to remove air pockets, preliminary flushing, and filling the main with chlorinated water having a free chlorine concentration of no less than 25 mg/l. At the end of a 24-hour contact time, the heavily chlorinated water, having a free chlorine residual of not less than 10 mg/l, shall be flushed from the main until the chlorine concentration leaving the main is no higher than that prevailing in the existing distribution system. Neutralize the heavily chlorinated water leaving the main with one of the chemicals named in Appendix C of AWWA C651. Make final, permanent connections to existing mains in accordance with Section 4.6 of AWWA C651. Conduct bacteriological sampling and testing in accordance with Section 5 of AWWA C651. After sampling, maintain a minimum pressure of 20 psig in the mains until regulatory permission is granted to place the mains into service. Provide satisfactory test results consisting of two consecutive sets of samples, taken at least 24 hours apart, showing the absence of total coliform organisms and the presence of a chlorine residual. If necessary, re-disinfect until satisfactory test results are obtained.

50.28 PROTECTION

At the end of each workday the mains under construction shall be plugged to prevent the entry of small animals or rodents. Temporary plugs shall be provided for this purpose. Keep all valves closed during construction.

50.29 RESTORATION OF DAMAGED SURFACES, STRUCTURES AND PROPERTY

Where pavement, trees, shrubbery, fences or other property and surface structures not designated as pay items, have been damaged, removed or disturbed by the CONTRACTOR, whether deliberately or through failure to carry out the requirements of the Contract Documents, state laws, municipal ordinances or the specific direction of the Engineer, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced and repaired at the expense of the CONTRACTOR to a condition equal to that before work began within a time frame approved by the Engineer.

50.30 RESTORATION AND CLEAN-UP

50.30.1 RESTORATION

1. General: Restoration of areas disturbed by the CONTRACTOR's operations shall begin as soon as practical. CONTRACTOR's restoration operations shall keep pace with utility installation. Engineer reserves the right to halt utility installation until restoration and clean-up requirements are satisfied.

2. Time Frame for Restoration: Restoration of areas disturbed by the CONTRACTOR's operations shall begin no later than 14 days and shall be completed (excluding punch list items) no later than 28 days from the time construction first began in the area. No more than 1,000 LF along the path of the work may be completely unrestored (excluding punch list items) at the end of each day.

50.30.2 CLEAN-UP

The CONTRACTOR shall maintain the site of the work in a neat condition. The CONTRACTOR shall remove all excess materials, excess excavated materials, and all debris resulting from his operations a minimum of once per week.

APPENDIX A

LIST OF MATERIALS AND APPROVED MANUFACTURERS
(FEBRUARY 2023)

TOWN OF HILLIARD

STANDARD SPECIFICATIONS
FOR UTILITY CONSTRUCTION

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)

ITEM	MANUFACTURERS	PART NUMBER
WATER DISTRIBUTION		
Gate Valves:		
4-inch and larger (Mech. Joint)	1. United Water Products	1. 2010
	2. American Flow Control (American Cast Iron Co.)	2. 2500 Series
	3. AVK (S/S Stem Only)	3. Series 45
	4. Clow Valve	4. F-6100
	5. Kennedy Valve Company	5. 8571
	6. Mueller	6. A2360, A2361
	7. M & H Valve Company	7. 4067
	8. U.S. Pipe	8. 250
	9. Mueller Co.	9. A-2361 Series
	10. American-RD (Product line of Kennedy Valve	10. D100
Swing Check Valve:	1. Kennedy/Clow/M&H	1. 159-02/106 ALW
	2. Mueller	2. A-2604-6-01
	3. American Flow Controls	3. 52SC
	4. Flomatic	4. Model 90/92
Fittings:		
(DI), (C153 SSB/C110 FLG, Cement Lined)	1. Tyler Union	1. N/A
	2. Star Pipe Products	2. N/A
	3. Sigma Corp. (Russell Pipe)	3. N/A
	4. SIP Industries	4. N/A
Pipe:		
2-inch Service Pipe (Color Coded)	1. JM Eagle Manufacturing	1. N/A
	2. National Pipe and Plastics	2. N/A
	3. North American Pipe Co. (NAPCO)	3. N/A
	4. Universal 100 / Accord	4. N/A
	5. Charlotte Pipe and Foundry Co.	5. N/A

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)

ITEM	MANUFACTURERS	PART NUMBER
WATER AND DISTRIBUTION (Cont'd)		
4-inch to 16-inch - PVC WM (Color Coded)		
4-inch to 12-inch	1. Diamond Plastics	1. N/A
4-inch to 12-inch	2. JM Eagle	2. N/A
4-inch to 12-inch	3. National Pipe & Plastics/ National PVC)	3. N/A
4-inch to 12-inch	4. North American Pipe Co. (NAPCO	4. N/A
4-inch to 12-inch	5. Ipex	5. N/A
4-inch to 12-inch	6. Sanderson Pipe Corp.	6. N/A
16-inch	1. Diamond Plastics	1. N/A
16-inch	2. JM Eagle	2. N/A
16-inch	3. National Pipe & Plastics/	3. N/A
16-inch	4. North American Pipe Co.	4. N/A
16-inch	5. Ipex	5. N/A
4-inch and larger Ductile Iron	1. American Cast Iron Pipe Company	1. N/A
	2. McWane Ductile	2. N/A
	3. U.S. Pipe	3. N/A
Tubing:		
3/4, 1 and 1-1/2-inch	1. Endot-Yardley	1. EndoPure
	2. Phillips Driscopipe/ Performance Pipe	2. N/A
	3. Charter Plastics	3. Blue Ice
	4. Silver-Line Plastics	4. N/A
Tapping Valve:	1. American Flow Control (American Cast Iron Co.)	1. N/A
	2. AVK (S/S Stem Only)	2. 25/30081
	3. Clow Valve	3. F6114, 2638
	4. Kennedy Valve Company	4. 950-X
	5. M & H Valve	5. 4751
	6. Mueller	6. T-2360, T-2361
	7. U.S. Pipe	7. 5860
	8. Mueller-Aqua Grip	8. A-2361-76
	9. American – RD (Product Line of Kennedy Valve)	9. NA

Tapping Sleeve:		
(Stainless Steel) for size on size tap	1. Cascade Waterworks Mfg.	1. CST-EX
4-inch and larger	2. Dresser Inc./GE	2. 630
	3. Ford Meter Box Company	3. FAST Series, FTSS
	4. JCM Industries, Inc.	4. 432, 439, 452 (14-inch and larger)
	5. Power Seal	5. 3490, 3490 MJ (8-inch and smaller)
	6. Romac Industries, Inc.	6. SST
	7. Smith-Blair	7. 663 & 665
	8. Mueller	8. H304
Restraining Devices:		
(PVC Pipe)	1. EBAA Iron	1. 2000 PV, 2000 SV
All sizes	2. Ford Meter Box Co. (Uniflange)	2. 1500
	3. Sigma (Russell Pipe)	3. One-Lok SLCE
	4. Star Pipe Products	4. AllGrip
	5. Star Pipe Products	5. Stargrip 4000
	6. Tyler Union	6. TUFGrip TLP
	7. SIP	7. EZPVC/EZVCU
	1. EBAA Iron	1. 1500, 1600 Series
	2. EBAA Iron	2. 2500 Series
	3. EBAA Iron	3. 2800 Series
	4. Ford Meter Box Co. (Uniflange)	4. 1300 Series
	5. Ford Meter Box Co. (Uniflange)	5. 1350, 1360 Series
	6. Ford Meter Box Co. (Uniflange)	6. 1390 Series
	7. JCM	7. 610 Series
	8. JCM	8. 621 Series
	9. Romac	9. Grip Ring
	10. Star Pipe Products, Inc.	10. 1000, 1100
	11. Star Pipe Products, Inc.	11. 1200 Series
	12. Star Pipe Products, Inc.	12. ALLGRIP 3600
	13. Star Pipe Products, Inc.	13. 4100
	14. Sigma (Russell Pipe)	14. PWP
	15. Tyler Union	15. 3000
	16. SIP	16. PTPVC
(DIP)	1. EBAA Iron	1. 1100
All sizes	2. Ford Meter Box Co. (Uniflange)	2. 1400
	3. Sigma (Russell Pipe)	3. One-Lok SLDE
	4. Star Pipe Products	4. Stargrip 3000
	5. Star Pipe Products	5. AllGrip
	6. Tyler Union	6. TUFGrip TLD
	7. SIP	7. EZD
	1. EBAA Iron	1. 1500, 1600 Series
	2. Ford Meter Box Co. (Uniflange)	2. 1300 Series
	3. Ford Meter Box Co. (Uniflange)	3. 1390 Series
	4. JCM	4. 610 Series
	5. JCM	5. 621 Series
	6. Romac	6. Grip Ring
	7. Star Pipe Products, Inc.	7. 1000, 1100
	8. Star Pipe Products, Inc.	8. ALLGRIP 3600

**APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)**

ITEM	MANUFACTURERS	PART NUMBER
WATER DISTRIBUTION (Cont'd)		
	9. Star Pipe Products, Inc.	9. Stargrip 3100
	10. Sigma (Russell Pipe)	10. PWP
Corporation Stops:		
2-inch and smaller	1. Ford Meter Box Company	1. 1000 Series
	2. A.Y. McDonald Mfg.	2. 4700 Series
	3. Mueller	3. H Series
	4. Mueller	4. B Series
	5. James Jones Company	5. N/A
	6. Cambridge Brass	6. N/A
Curb Stops:		
2-inch and smaller	1. Ford Meter Box Company	1. B11 Series (w/lockwing, FIPxFIP
	2. Ford Meter Box Company	2. B41 Series (w/lockwing)
	3. McDonald A.Y. McDonald Mfg	3. 6100 Series (w/lockwing)
	4. Mueller	4. B20200 (w/lockwing, FIPxFIP)
	5. Mueller	5. B25170 (w/lockwing)
	6. James Jones	6. N/A
	7. Cambridge Brass	7. N/A
Boltless Coupling:		
2-inch and smaller	1. Dresser, Inc./GE	1. Style 65
	2. Smith-Blair	2. 525
	3. TPS	3. Series 6000
Brass Adapter & Coupler:		
2-inch and smaller	1. The Ford Meter Box Co.	
	2. McDonald A.Y. McDonald Mfg	
	3. Mueller	
	4. James Jones	
	5. Cambridge Brass	
Service Saddle, Double Strap:		
2-inch and smaller	1. Cascade Waterworks Mfg	1. CDS2/CDS-LD
	2. Dresser, Inc./GE	2. 291DS
	3. Ford Meter Box Co.	3. FC-202, 202BS
	4. JCM Industries	4. 406
	5. Smith-Blair	5. 317
	6. Mueller	6. DR 25
	7. Power Seal	7. 3417, 3409

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
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ITEM	MANUFACTURERS	PART NUMBER
WATER DISTRIBUTION (Cont'd)		
Service Saddle, Single Strap:		
1-inch and smaller	1. Cascade Waterworks Mfg	1. CDS2
	2. Dresser, Inc./GE	2. 291-SS
	3. Ford Meter Box Co.	3. FC-101
	4. JCM Industries	4. 405
	5. Smith-Blair	5. 315
	6. Mueller	6. DR1S
	7. Power Seal	7. 3417, 3409
Fire Hydrants:		
(Size - 5 1/4" Barrel)	1. American Flow Control	1. B-84-B
	2. M & H Valve Company	2. 129
	3. Mueller Co.	3. A-423
	4. US Pipe/Muller	4. Met M94
	5. AVK	5. 2780
WATER METER BOX SPECIFICATIONS		
Single Meter Box:	1. Glassmasters	1. N/A
	2. Southern Meter Box	2. N/A
	3. Pentek	3. N/A
Single Meter Box Lids:		
***All meter box lids are to have an AMR hole for radio read meters**		
Backflow Assembly RPZ & Check Valve Assemblies:	Determined by the Town of Hilliard	
WASTEWATER COLLECTION/TRANS.		
Plug Valve:	1. Clow Valve /Kennedy	1. N/A
	2. Dezurik	2. N/A
	3. DeZurik	3. N/A
	4. TYCO/Keystone	4. Eccentric Valve
	5. Milliken Valve or Mueller Water Products	5. 600 N (MJ)
	6. Milliken Valve or Mueller Water Products	6. 601 N (MJ)
	7. Henry Pratt Co.	7. N/A
	8. Val-Matic	8. N/A
	9. Golden Anderson	9. N/A
	10. Homestead	10. NA

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ITEM	MANUFACTURERS	PART NUMBER
Check Valve:	1. American Flow Control	1, 59SC-LW
	2. Clow Valve/Kennedy	2. 106LW
	3. M & H Valve	3. 159-02
	4. Mueller/CNNE (Charles	4. 8001
	5. NIBCO	5. F938-31-BL&W
	6. Matco-Norca	
	7. Golden Anderson	
	8. United	
Air Release Valve:	1. Vent-O-Mat	1. Series RGX II
	2. A.R.I. USA	2. D-025-ST/D-26 NS
	3. H-TEC USA	3. Series 989986
Fittings (DI) (C153 SSB/C110 FLG &	1. Tyler Union	1. N/A
	2. Star Pipe Products	2. N/A
	3. Sigma Corp. (Russell Pipe)	3. N/A
	4. SIP Industries	4. N/A
	5. US Pipe	5. N/A
Restraining Devices:		
(PVC) 3-inch and larger	1. EBAA Iron	1. 2000 PV, 2000 SV
3-inch and larger	2. Ford Meter Box Co. (Uniflange)	2. 1500
3-inch to 10-inch	3. Sigma (Russell Pipe)	3. One-Lok SLCE
12-inch and larger	3. Sigma (Russell Pipe)	3. One-Lok SLCE
3-inch and larger	5. Star Pipe Products	5. Stargrip 4000
3-inch and larger	6. Tyler Union	6. TUFGrip TLP
3-inch and larger	7. SIP	7. EZPVC/EZVCU
3-inch and larger	1. EBAA Iron	1. 1500, 1600 Series
3-inch and larger	2. EBAA Iron	2. 2500 Series
3-inch and larger	3. EBAA Iron	3. 2800 Series
3-inch and larger	4. Ford Meter Box Co. (Uniflange)	4. 1300 Series
3-inch and larger	5. Ford Meter Box Co. (Uniflange)	5. 1350, 1360 Series
3-inch and larger	6. Ford Meter Box Co. (Uniflange)	6. 1390 Series
3-inch and larger	7. JCM	7. 610 Series
3-inch and larger	8. JCM	8. 621 Series
3-inch and larger	9. Romac	9. Grip Ring
3-inch and larger	10. Star Pipe Products, Inc.	10. 1000, 1100
3-inch and larger	11. Star Pipe Products, Inc.	11. 1200 Series
3-inch and larger	12. Star Pipe Products, Inc.	12. ALLGRIP 3600
3-inch and larger	13. Star Pipe Products, Inc.	13. 4100
3-inch and larger	14. Sigma (Russell Pipe)	14. PWP
3-inch and larger	15. Tyler Union	15. 3000
3-inch and larger	16. SIP	16. PTPVC

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)

ITEM	MANUFACTURERS	PART NUMBER
(DIP) 3-inch and larger	1. EBAA Iron	1. 1100
3-inch and larger	2. Ford Meter Box Co. (Uniflange)	2. 1400
3-inch and larger	3. Sigma (Russell Pipe)	3. One-Lok SLDE
3-inch and larger	4. Star Pipe Products	4. Stargrip 3000
3-inch and larger	5. Tyler Union	5. TUFGrip TLD
3-inch and larger	6. SIP	6. EZD
3-inch and larger	1. EBAA Iron	1. 1500, 1600 Series
3-inch and larger	2. Ford Meter Box Co. (Uniflange)	2. 1300 Series
3-inch and larger	3. Ford Meter Box Co. (Uniflange)	3. 1390 Series
3-inch and larger	4. JCM	4. 610 Series
3-inch and larger	5. JCM	5. 621 Series
3-inch and larger	6. Romac	6. Grip Ring
3-inch and larger	7. Star Pipe Products, Inc.	7. 1000, 1100
3-inch and larger	8. Star Pipe Products, Inc.	8. ALLGRIP 3600
3-inch and larger	9. Star Pipe Products, Inc.	9. Stargrip 3100
3-inch and larger	10. Sigma (Russell Pipe)	10. PWP
Sewer Pipe (Green PVC), Gravity:	1. Charlotte Pipe	1. N/A
6-inch and larger	2. Diamond Plastics Corp.	2. N/A
	3. JM Eagle	3. N/A
	4. National Pipe & Plastics	4. N/A
	5. North American Pipe (NAPCO)	5. N/A
	6. Sanderson Pipe Co.	6. NA
	7. HAWK Plastics Corp.	7. SDR-26
Sewer Gravity Sewer Fittings (PVC):	1. Diamond Plastics	1. N/A
16-inch	2. JM Eagle	2. N/A
	3. National Pipe & Plastics/ National PVC)	3. N/A
	4. North American Pipe (NAPCO)	4. N/A
	5. Ipex	5. N/A
Casing Spacers:	1. Cascade Waterworks Mfg.	1. CCS
	2. Pipeline Seal & Insulator, Co (EnPro Industries, Inc.)	2. S/S Type
	3. Pipeline Seal & Insulator, Co (EnPro Industries, Inc.)	3. PVC Coated Steel
	4. Pipeline Seal & Insulator, Co (EnPro Industries, Inc.)	4. Ranger II
	5. Raci Spacers	5. High Density Polyethylene
	6. BWM Company	6. N/A
	7. Advanced Products & Sys.	7. SSI, SI, CI
	8. CCI Pipeline Systems	8. CSC, CSS

TOWN OF HILLIARD

STANDARD SPECIFICATIONS
FOR UTILITY CONSTRUCTION

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)

ITEM	MANUFACTURERS	PART NUMBER
Manhole Frame and Cover	1. U.S. Foundry	1. USF-655
32-inch	2. East Jordan Iron Works	2. N/A
Manhole Riser Rings	1. Old Castle	
	2. Lad Tech, HDPE Rings	
	3. EJ, Steel Adjustment Ring	
	4. EJ, infra-riser	
	5. Cretex Pro-Ring, EPP Adjustment Ring	
Precast Manhole	1. Old Castle	1. N/A
	2. Del Zotto Precast	2. N/A
	3. FORTERRA	3. N/A
	4. American Precast	4. N/A
Manhole Joint Sealant		
1-inch	1. Con-Seal	1. CS102, 202
1-1/2 inch	2. Ram-Nek/Henry Company	2. Ram-Nek
	3. NPC Bidco/Trelleborg	3. C-56
1-inch	4. Evergrip	4. 990
Manhole Exterior Joint Material		
0.1-inch x 8-inch W (min)	1. Con Seal	1. CS-300, CS-212
9-inch W (min)	2. Rub-R-Nek/Henry Company	2. N/A
18-inch W (min)	3. Wrapid Seal (CCI Pipeline Systems	3. N/A
Manhole Surface Coatings	1. Sherwin-Williams	1. Josh Hinson, 904-591-3137 swrep4538@sherwin.com
	2. Corrocoat USA, Inc.	2. Josh Tankersley, 904-472-0768 Josht@corrocoat.com
	3. PPG Protective & Marine Coatings	3. Jim Hartley, 904-626-6382 jim.hartley@ppg.com
	4. Tnemec (Capital Only)	
Station Basins – Concrete:	1. Associated Fiberglass Enterprises	1. Hard Shell Liner (*****)
Station Basins - FRP	2. Concrete Conservation, Inc.	2. Spectra-Shield (***)
	3. L.F. Manufacturing, Inc.	3. Hard Shell Liner (*****)
	4. LaFarge/Kerneos, Inc. Calcium Aluminates	4. SEWPERCOAT (**)
	5. GML Coatings, LLC	5. Green Monster (***)
	6. Derakane	6. 8084 Resin (*)
	7. Armorock	7. Rehabilitation Insert (*****)
	8. Sprayroq	8. Spraywall (****)

NOTES: (*) Surface Primer; (**) Cementitious or Polymer Modified Cementitious Coating; (***) Epoxy, Polyurea or Polyurethane Corrosion Inhibiting Coating; (****) Epoxy, Polyurea or Polyurethane Structural Coating; (*****) Fiberglass or Polymer Concrete Liner Material

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURERS
(Revised February 2023)

ITEM	MANUFACTURERS	PART NUMBER
WASTEWATER PUMPING STATION		
Submersible Pumps:		
Submersible WW 1800 rpm Pumps	1. Flygt	1. David Williams, 239-825-8384
	2. WILO-EMU	2. PSI Technologies, 904-588-2132
	3. KSB	3. Custom Pump, 904-858-9605
	4. Hydromatic (40HP or less)	4. Barney's Pump, 904-260-0669
	5. Shinmaywa	5. David Lee, 904-228-7602
Submersible WW 3600 rpm Pumps	1. Flygt	1. David Williams, 239-825-8384
	2. KSB	2. Custom Pump, 904-858-9605
Dry-Pit Wastewater Pumps	1. WILO-EMU	1. PSI Technologies, 904-588-
	2. Flow Serve (MSX)	2. Carter & Ver Planck,813-287-0709
	3. KSB	3. Custom Pump, 904-858-9605
	4. Flygt	4. David Williams, 239-825-8384
Flooded Suction Solids Handling Pumps	1. Fairbanks Morse	1. Sanders Company, 772-220-2900
	2. Worthington	2. Carter & Ver Planck,813-287-0709
	3. Allis Chalmers	3. David Williams, 239-825-8384
Low Pressure System (LPS)	1. Flygt	1. David Williams, 239-825-8384
	2. Hydromatic	2. Barney's Pump, 904-260-0669
	3. Myers MW50	3. Custom Pump, 904-858-9605

This list will be reviewed and revised annually to ensure that there are at least three vendors for each item listed in Appendix A.

APPENDIX B

CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER MAINS AND LATERALS

TOWN OF HILLIARD

STANDARD SPECIFICATIONS FOR UTILITIES CONSTRUCTION

APPENDIX B

CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER MAINS AND LATERALS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Section Includes: Requirements to execute internal closed circuit television (CCTV) survey to inspect sewer mains and laterals.

1.02 SUBMITTALS:

A. Submit the following:

1. Sample of television survey log, DVD/CD-ROMs, and equipment list for approval before commencement of work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:

1. Provide equipment to perform inspections of sewer mains located in streets, street rights-of-way, and off-road easements.

a. Including but not limited to portable CCTV equipment, vehicles capable of transporting TV equipment and accessing remote easements, and adequate cleaning equipment.

b. Pipe plugs, pumps, equipment, and operators as needed to prepare and maintain sewer system conditions for test period.

2. Certify that backup equipment is available and can be delivered to site within 48 hours.

B. Software Requirements: PACP certification and video recording.

C. CCTV:

1. Color Video Camera

a. Specifically designed and constructed for this application.

b. Camera, 17-inch minimum, Closed Circuit, Color Television Monitor, and Other Components: Capable of producing a color video picture with a standard resolution of 720 x 480.

c. Produce 720 x 480 line resolution minimum.

d. Pan and tilt type, capable of turning at right angles to pipe's axis over an entire vertical circle (minimum pan of 270 degrees and rotation of 360 degrees).

e. Lighting: Suitable to allow clear picture of entire inner pipe wall extending at least 10 feet in front, including black High Density Polyethylene (HDPE) pipe.

f. Operative in 100 percent humidity conditions.

g. Image: Capable of self righting itself.

h. Include data view display feature capable of showing on tape following information.
   1) Lateral addresses.
   2) Town and state.
   3) Date and time.
   4) Project name.
   5) Contractor's name.
   6) Inside pipe diameter and type.
   7) Manhole identification (upstream manhole to downstream manhole).
   8) On-going footage counter accurate within 0.2 foot, per 100 feet.
   9) Include operator narration, in format approved by Town Inspector, using Commission approved terminology.
   10) Recording of single section of sewer onto 2 DVD/CD-ROMs will not be acceptable.
   11) Clearly label each DVD/CD-ROM as approved by the City Inspector.

i. Mounting
   1) Launched From Within Mainline Sewer: Mounted on tread tractor that moves through sewers and positions inspection camera launcher opposite lateral line connection.
   2) Launched From Within A Cleanout: Able to travel to mainline sewer.

j. Attachment: Push cable with a fiberglass rod core.

D. Recording Media:

1. Provide a high quality DVD in a MPEG2 format video with a standard resolution of 720 x 480.

2. Camera, Television Monitor, and Other Components: Capable of producing a minimum 720 x 480 line resolution color video picture.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION SURVEY:

A. Procedure:

1. CCTV:

a. Mainline:
1) Before repair work, light clean and inspect sewer line from manhole to manhole, preferably upstream to downstream, one section at a time.
a) Light cleaning includes up to 3 passes with a hydraulic jet cleaner.
b) Heavy cleaning by method approved by Town Inspector.
2) Maintain sewer main isolation by plugging or bypass pumping while camera is moving and recording.
a) Plugs: Secured so as to remain in place during inspection.
b) Conduct operations to prevent building backups and sewer overflows.
c) Be responsible for clean-up, repair, fines, property damage costs and claims for any sewage backup, bypass spillage or sanitary sewer overflow.

b. Lateral: Follow mainline above, except as modified below.
1) Inspect entire lateral. Simultaneous with CCTV inspection clean and flush lateral with clean water.
2) Isolate section inspected
a) Method may include turning off property water, or bypassing flow.
3) Prevent backflow into laterals.
4) Identify inspection by building address and mainline.
a) If lateral services 2 addresses, identify both addresses.

2. Placement of Camera:

a. Manhole:
1) Place at center of manhole and commence video recording before entering pipe.
2) Start footage counter at center of manhole.

b. Mainline: Mount on a transport platform that will keep it centered along longitudinal axis of sewer mainline and above water.

c. Laterals From Mainline:
   1) Place camera into connection and commence video recording before entering connection.
   2) Start footage counter at connection.

d. Laterals From Cleanout:
   1) Place camera into sweep and commence video recording before entering lateral or before lowering through cleanout stack.
   2) Start footage counter at sweep.

3. Operation of Camera:

a. Provide full 360 degree pan of all pipe joints. Camera shall be located precisely at each joint. Film the entire circumference at each joint.

b. Show inside of manhole walls, manhole channel, and pipe connection to wall at both upstream and downstream manhole and lateral connections.

c. Move through line at speed no greater than 30 feet per minute stopping for minimum 10 seconds to record lateral connections, mainline connections, defects, and features and points of interest.

d. Maintain technical quality, sharp focus, and distortion free picture.

e. Videotape a section of sewer in its entirety with no breaks or interruptions.

f. Pan, tilt, and rotate as necessary to best view and evaluate lateral connections, defects, features, and points of interest.

g. Use power winches, powered rewinds, tractors, or other devices that do not obstruct camera view or interfere with proper documentation of sewer conditions to move camera through sewer.
   1) Whenever non-remote powered and controlled winches are used set up telephones or other suitable means of communication between manholes to ensure good communications.

h. Use hydraulic jet nozzle if necessary to remove standing water from line.

i. Eliminate steam in line for duration of inspection.
   1) Utilize blower as needed to defog sewer line.

j. Measurement for Location of Defects and Service Laterals:
   1) At ground level by means of Town Inspector-approved footage counter or metering device.
   2) Measurement Meters: Accurate to 0.2 foot over length of section being televised.
   3) Use measuring target in front of television as exact measurement reference point.

k. Movement of Television Camera:
   1) Mainline:
      a) Stop camera at service connections and inspect lateral with pan and tilt camera.
      b) At active service connections where flow is discharging.
         (1) Identify building address and confirm that laterals are active by obtaining flush, with or without dye, of property owner's commode or by using outside cleanout, if available.
         (2) If no flows are being discharged from building, consider observed flow as infiltration/inflow.
   2) Laterals:
      a) Move camera through lateral at uniform rate.
         (1) Stop at each suspected defect to allow adequate evaluation.

l. Identification of Defects:
   1) If roots, sludge, or sediment material impedes inspection, withdraw camera and re-clean mainline by hydraulic jet.
      a) Upon completion of re-cleaning operation, resume internal inspection.
      b) Furnish media confirmation for heavy cleaning (more than 3 passes with jet cleaner) to Town Inspector.
   2) If protruding tap impedes inspection, trim protruding tap to 1/2 inch.
   3) If obstructions are not passable and cannot be removed by sewer cleaning or reaming, withdraw CCTV equipment and perform inspection from opposite end.
      a) Extract camera stuck in sewer line.
      b) When additional obstructions are encountered after re-deployment of equipment and no means are available for passing obstructions, remand to Town Inspector for resolution.

B. Field Documentation:

1. Mainline:

a. Submit original records, logs, DVD's, CD-ROMs, and electronic data for sewer line inspection to Town Inspector at the end of the day's inspection. Copies of the inspection will be provided by the Town at Contractor's request.

b. Include, but not be limited to, the following information:
   1) Project Number.
   2) Basin Name.
   3) Owner.
   4) Date, time (begin to end inspections).
   5) Weather condition.
   6) Operator name.
   7) QA reviewer name.
   8) DVD/CD number and index.

9) Address of upper most lateral.
10) Manhole number to manhole number.
11) Manhole depths.
12) Length of pipe segment.
13) Direction of CCTV (Upstream or Downstream).
14) Pipe size.
15) Pipe material.
16) General physical conditions.
17) Footage locations, clock position, descriptions, and estimated leakage rates for visible point sources of infiltration/inflow.
18) Footage locations, clock position, and descriptions for lateral connections and estimated flow from laterals.
19) Footage locations, clock position, and descriptions of defects such as obstructions, root intrusion, blockages in pipe, deteriorated joints, offset joints, holes, breaks, cracks, collapses, bends or sags in alignment, or protruding lateral connections.
20) Footage locations, clock position, and descriptions of other defects, features and points of interest found.
21) Whether CCTV was complete or incomplete.

c. DVD/CD-ROM Recording/Playback:
1) At same speed that it was recorded.
2) Supply slow motion or stop motion playback features.
3) Once recorded, DVD/CD-ROM becomes property of the Commission.
4) Have DVD/CD-ROM and necessary playback equipment readily accessible for review by Town Inspector during Project.

d. Observation Terminology Utilized During Audio Narration: Follow the Commission approved terminology.

e. DVD/CD-ROMs displaying poor video quality refers to, but is not limited to, grease or debris on lens, camera under water, image too dark, washed-out, distorted, or out of focus, lines improperly cleaned, and poor/no audio.
1) Re-televise line if necessary and resubmit DVD/CD- ROM.

2. Laterals:

a. Submit as above for mainline documentation.

b. Include, but not limited to, the following information.
1) Project Number.
2) Basin Name.
3) Owner.
4) Date, time (begin to end inspections).
5) Weather condition.
6) Operator name.
7) QA reviewer name.
8) DVD/CD number and index.
9) Address of each lateral.
10) Length of lateral segment.

11) Direction of CCTV (from property line or from mainline connection).
12) Lateral size; lateral material.
13) General physical conditions.
14) Footage locations, clock position, and descriptions of defects and estimated leakage rates for visible point sources of infiltration/inflow.

3.02 POST-CONSTRUCTION SURVEY:

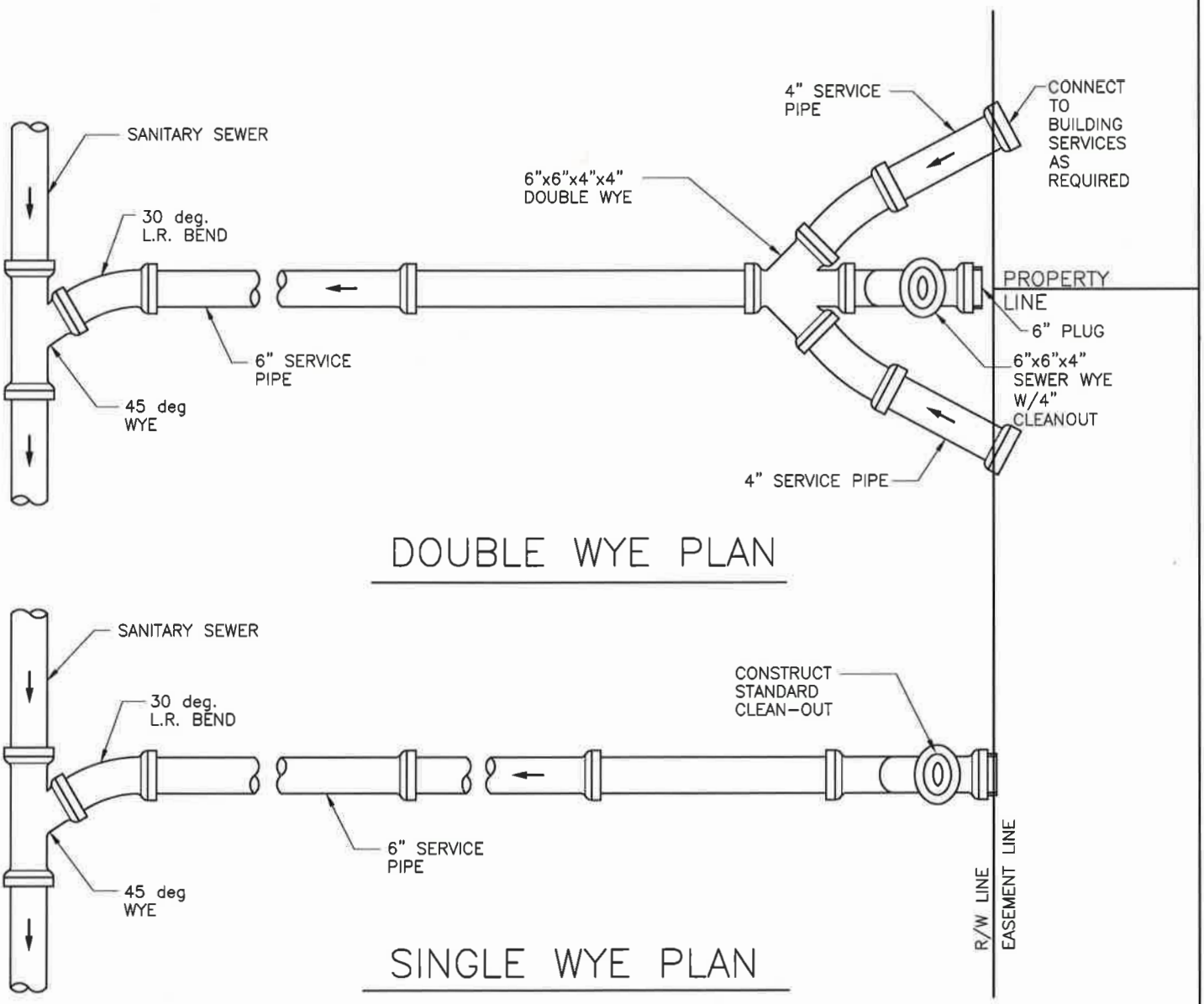
A. Procedure: Follow procedures as specified for pre-construction survey above and as specified below.

1. Stop camera (minimum 10 seconds) at beginning and end of repairs and inspect repaired section.

END OF SECTION

APPENDIX C

STANDARD UTILITY DRAWINGS

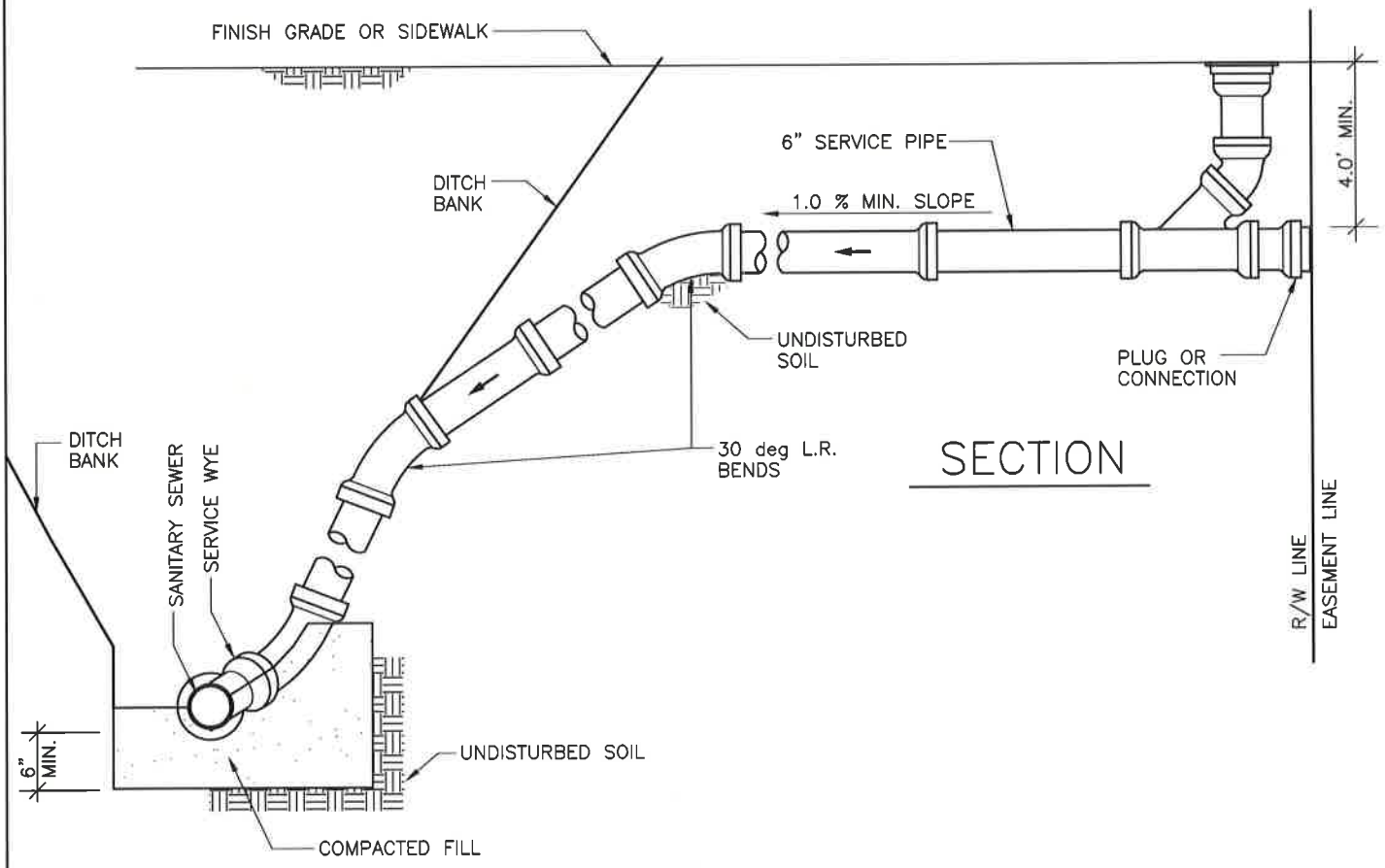


DOUBLE WYE PLAN

SINGLE WYE PLAN

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Sanitary Sewer Service Connections (Plan View)
Nassau County, Florida

FIGURE
S-1
March 2022
Project No.
9610-23-1
(Standards)



NOTES:

1. CONTRACTOR SHALL PROVIDE AN ADEQUATE SUPPLY OF 30° & 45° BENDS TO MEET VARYING FIELD CONDITIONS.
2. PROVIDE CLEANOUT AT RIGHT-OF-WAY
3. LENGTH OF SERVICE PIPE VARIES AT EACH SERVICE CONNECTION AND SHALL BE PROVIDED AS REQUIRED. TERMINATE SERVICE AT LOCATION DIRECTED BY THE ENGINEER.
4. SEWER LATERALS SERVING DWELLINGS WHOSE FINISH FLOOR ELEV. IS BELOW THE CROWN OF THE ROAD SHALL BE LAID AT A CONSTANT 1.00% SLOPE FROM THE POINT OF CONNECTION AT THE NEW GRAVITY SEWER TO THE PROPERTY LINE.

TOWN OF HILLIARD

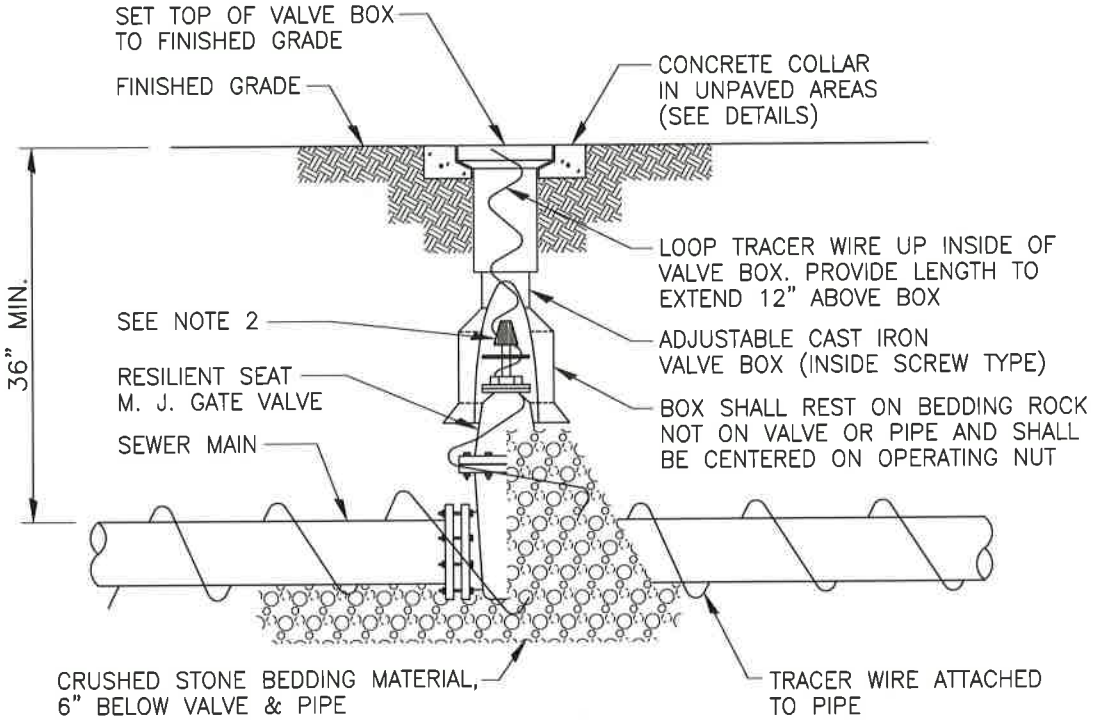
Standard Specifications for Utility Construction

Sanitary Sewer Service Connections (Section View)

Nassau County, Florida

FIGURE S-2

March 2022
Project No. 9610-23-1
(Standards)



NOTES:

1. PVC EXTENSIONS SHALL NOT BE USED ON VALVE BOX INSTALLATION.
2. THE ACTUATING NUT FOR DEEPER VALVES SHALL BE EXTENDED TO A MAXIMUM OF 4 FEET BELOW FINISHED GRADE.

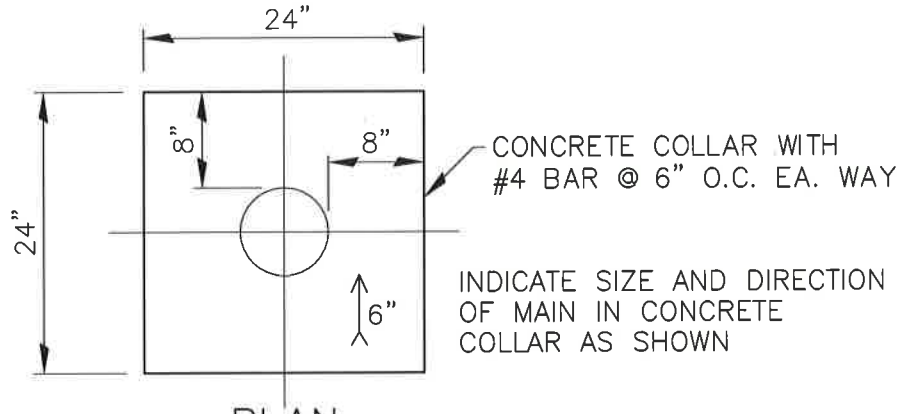
TOWN OF HILLIARD

Standard Specifications for Utility Construction

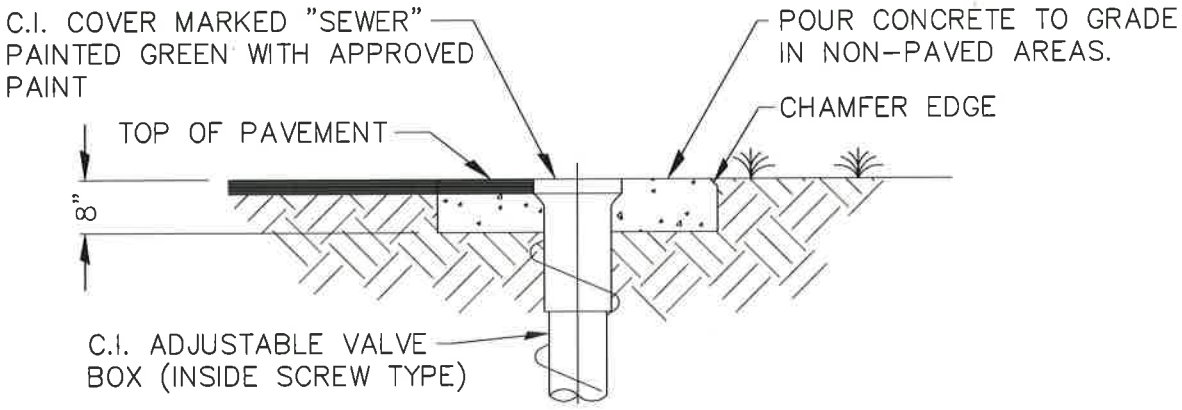
Gate Valve Detail

Nassau County, Florida

FIGURE
S-3
March 2022
Project No.
9610-23-1
(Standards)



PLAN



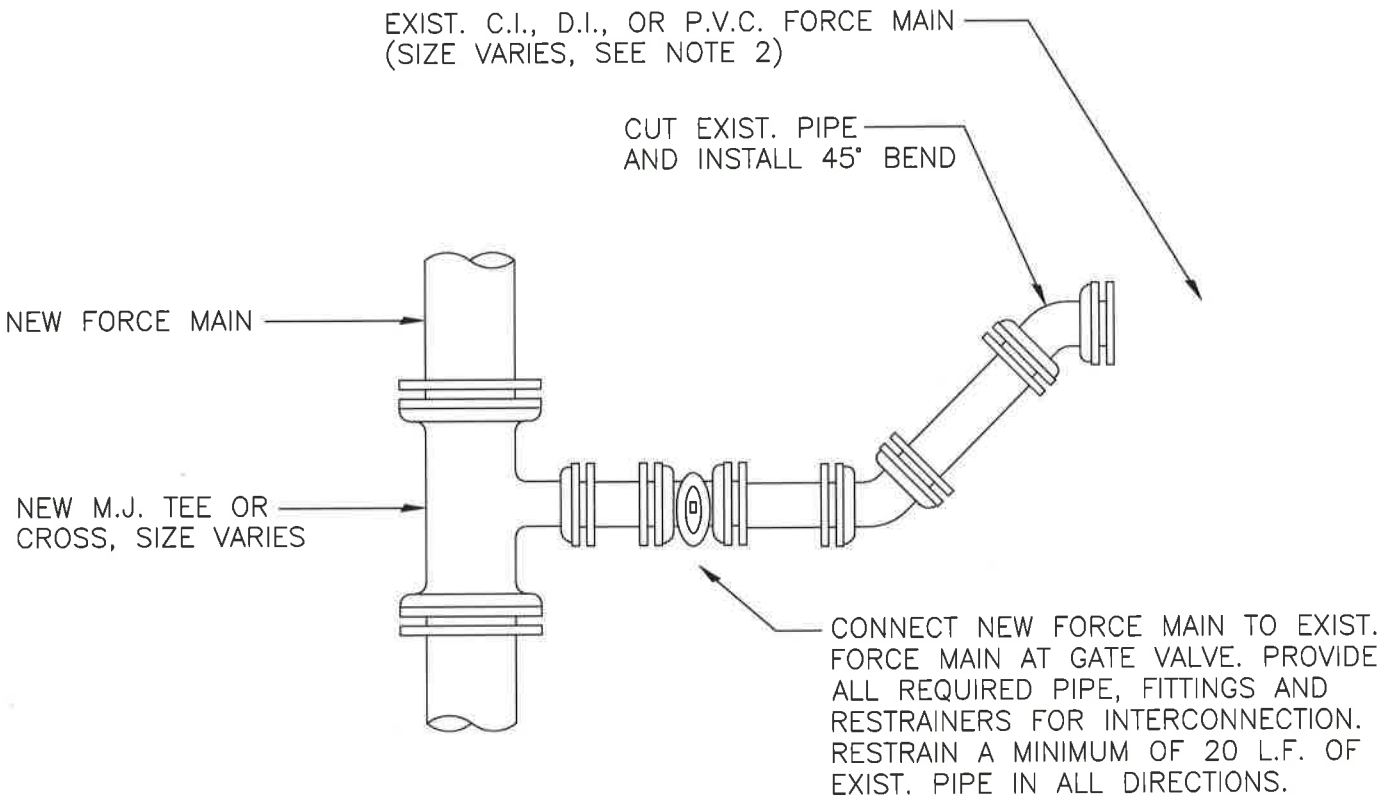
SECTION

NOTES:

1. CONCRETE COLLAR IS NOT REQUIRED IN PAVED AREAS IF PAVEMENT SURFACE IS FINISHED PRIOR TO CONDITIONAL FINAL INSPECTION.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Valve Collar Detail
Nassau County, Florida

FIGURE
S-4
March 2022
Project No.
9610-23-1
(Standards)



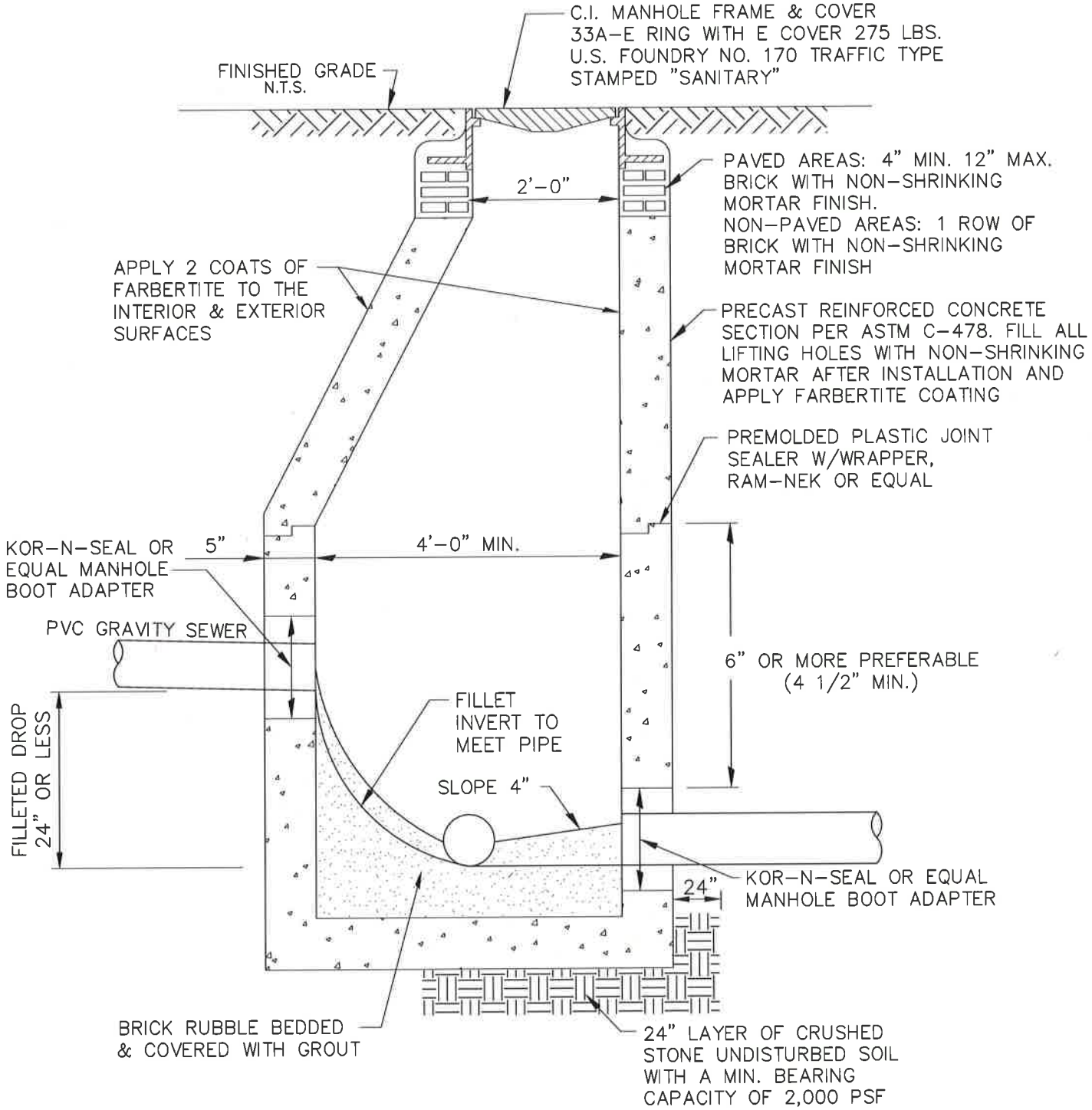
NOTES:

1. ALL PIPE, VALVES AND FITTINGS SHALL BE RESTRAINED IN ACCORDANCE WITH THE UTILITY STANDARDS.

2. THE CONTRACTOR/DEVELOPER SHALL PROVIDE ALL LINE STOP AND/OR INSERT-A-VALVE MECHANISMS AS REQUIRED TO ISOLATE THE TOWN'S SYSTEM PRIOR TO TIE-IN. THE TOWN DOES NOT WARRANTY ANY EXISTING PIPING CAN BE ISOLATED FOR CONNECTION.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Typical Existing Force Main Connection Detail
Nassau County, Florida

FIGURE
S-5
March 2022
Project No.
9610-23-1
(Standards)



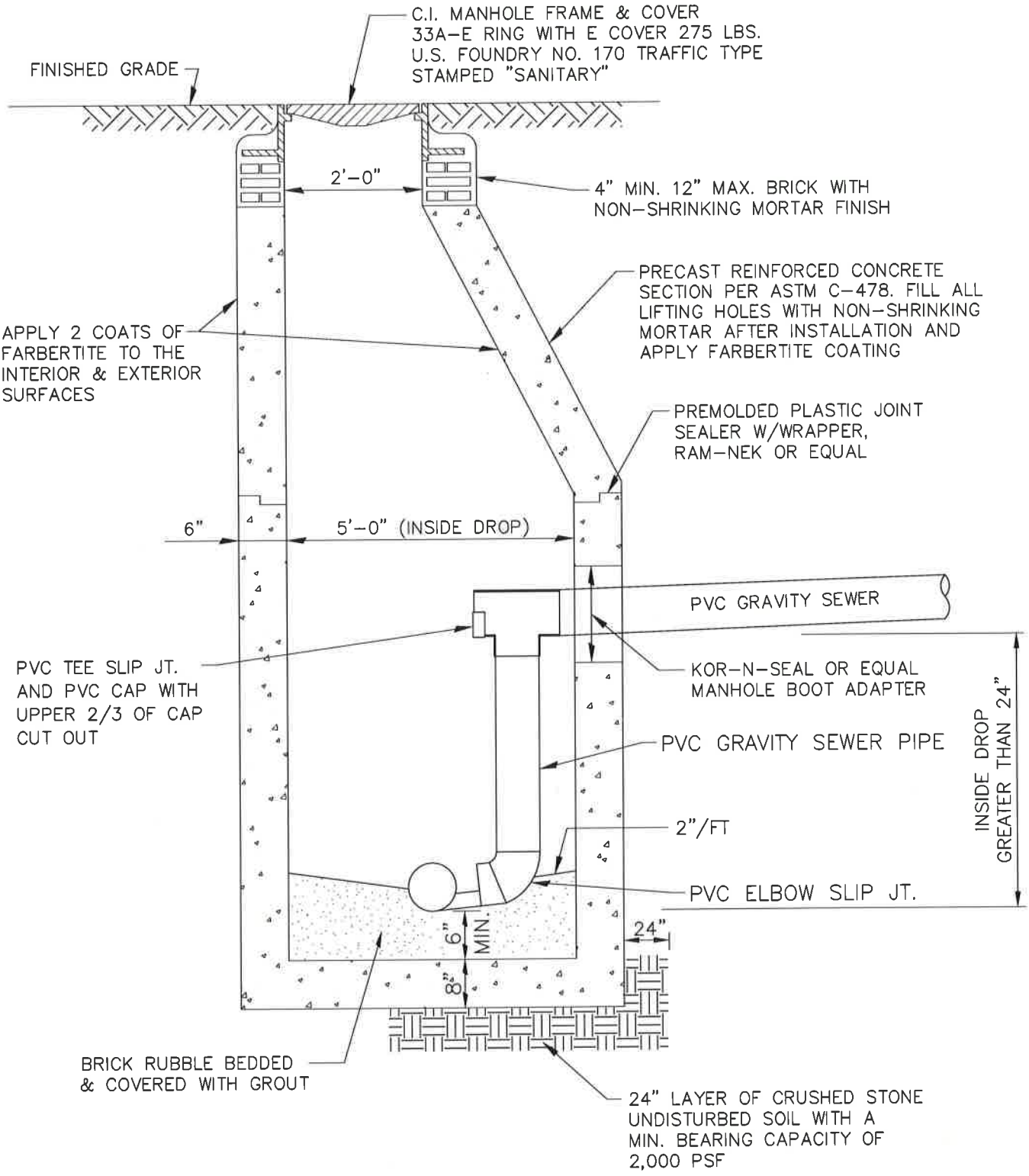
TOWN OF HILLIARD

Standard Specifications for Utility Construction

Standard Manhole Detail

Nassau County, Florida

FIGURE
S-6
March 2022
Project No.
9610-23-1
(Standards)



TOWN OF HILLIARD

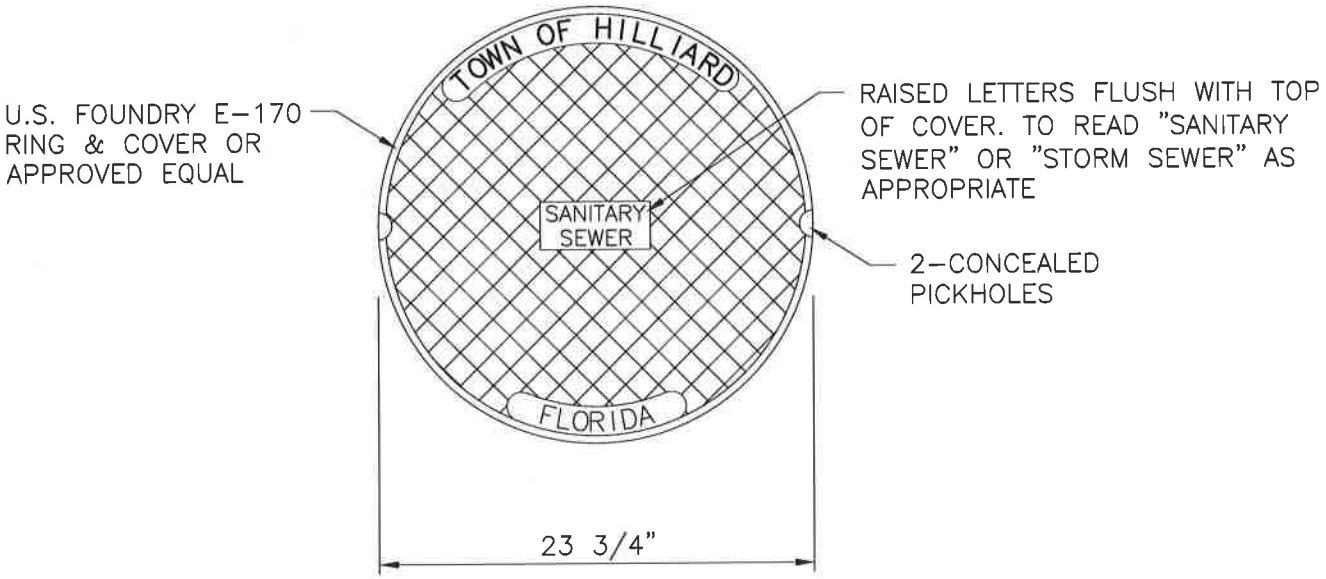
Standard Specifications for Utility Construction

Sanitary Sewer Drop Manhole Detail

Nassau County, Florida

FIGURE
S-7

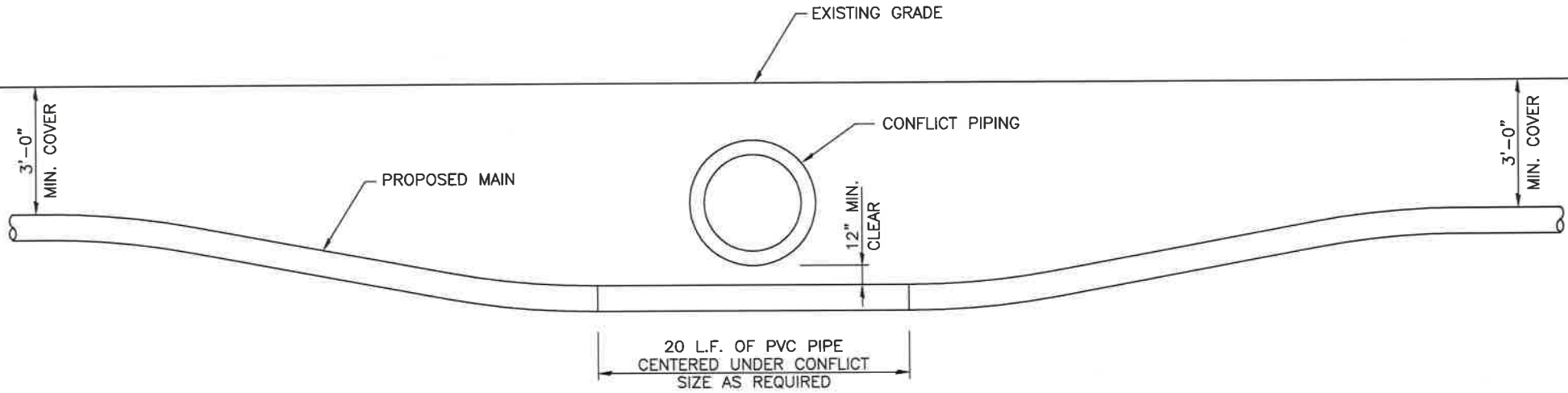
March 2022
Project No.
9610-23-1
(Standards)



NOTE:
FRAME & COVER SHALL BE MACHINED OR GROUND AT ALL BEARING SURFACES SO AS TO SEAT FIRMLY AND PREVENT ROCKING.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Manhole Cover Detail
Nassau County, Florida

FIGURE
S-8
March 2022
Project No.
9610-23-1
(Standards)



NOTES:

1. CONTRACTOR SHALL FULLY SUPPORT/BRACE ALL CONFLICT PIPING THROUGHOUT ENTIRE DURATION OF CONVENTIONAL INSTALLATION OF WATER MAIN UNDER CONFLICT MAIN.

2. CONTRACTOR SHALL BE REQUIRED TO FULLY REPAIR OR REPLACE ANY EXISTING PIPING DAMAGED DURING THE INSTALLATION PROCESS.

3. CONTRACTOR SHALL BE REQUIRED TO DIRECTIONAL DRILL UNDER ANY PIPING GREATER THAN 24" DIAMETER AND ANY CULVERTS WITH MORE THAN ONE CROSS DRAIN.

TOWN OF HILLIARD

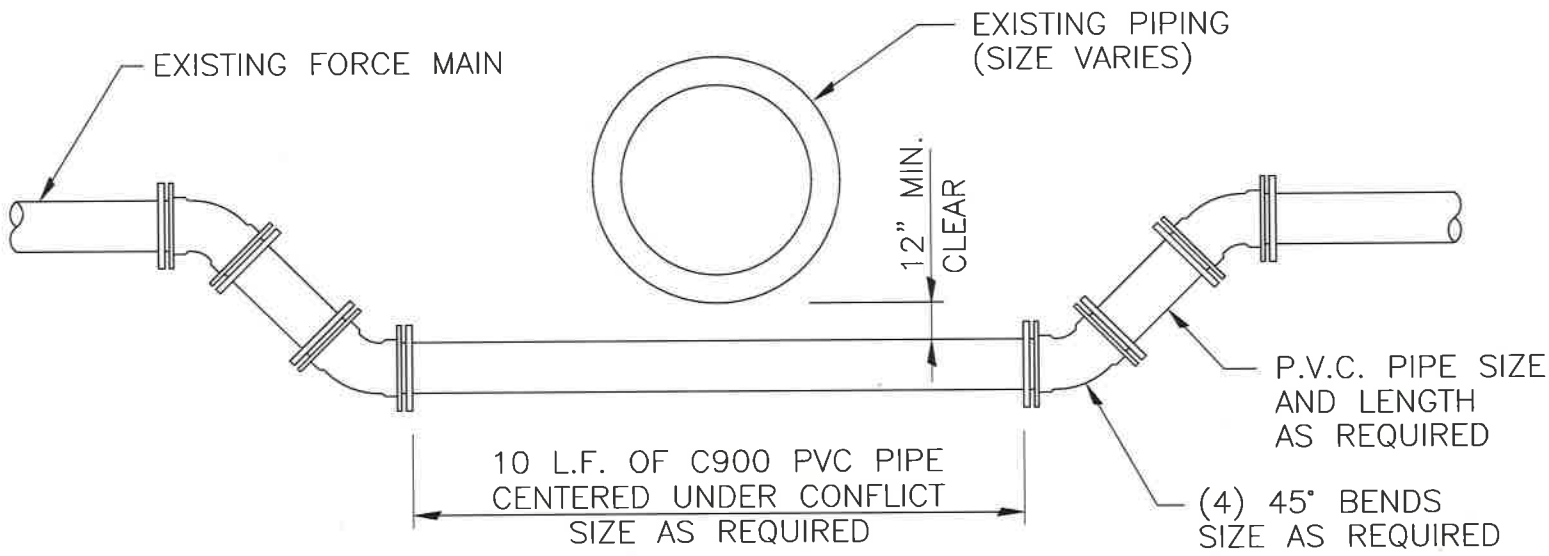
Standard Specifications for Utility Construction

Utility Conflict Type A

Nassau County, Florida

FIGURE
S-9

March 2022
Project No.
9610-23-1
(Standards)



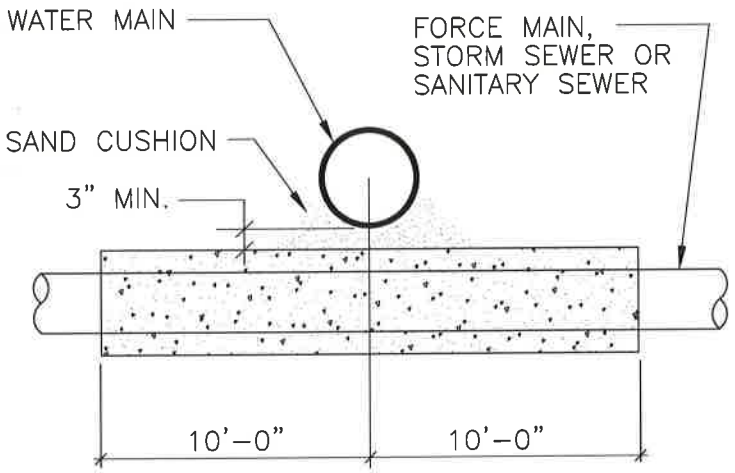
NOTES:

1. CONTRACTOR TO VERIFY EXISTING AND PROPOSED ELEVATIONS AT ALL UTILITY CONFLICT LOCATIONS.

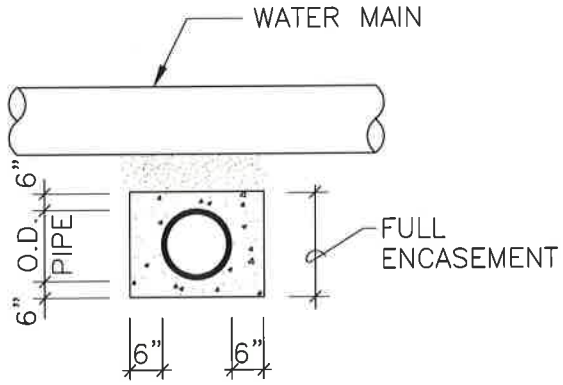
2. ALL JOINTS (PROPOSED AND EXISTING) AT UTILITY CONFLICTS SHALL BE MECHANICALLY RESTRAINED.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Utility Conflict Type B
Nassau County, Florida

FIGURE
S-10
March 2022
Project No.
9610-23-1
(Standards)

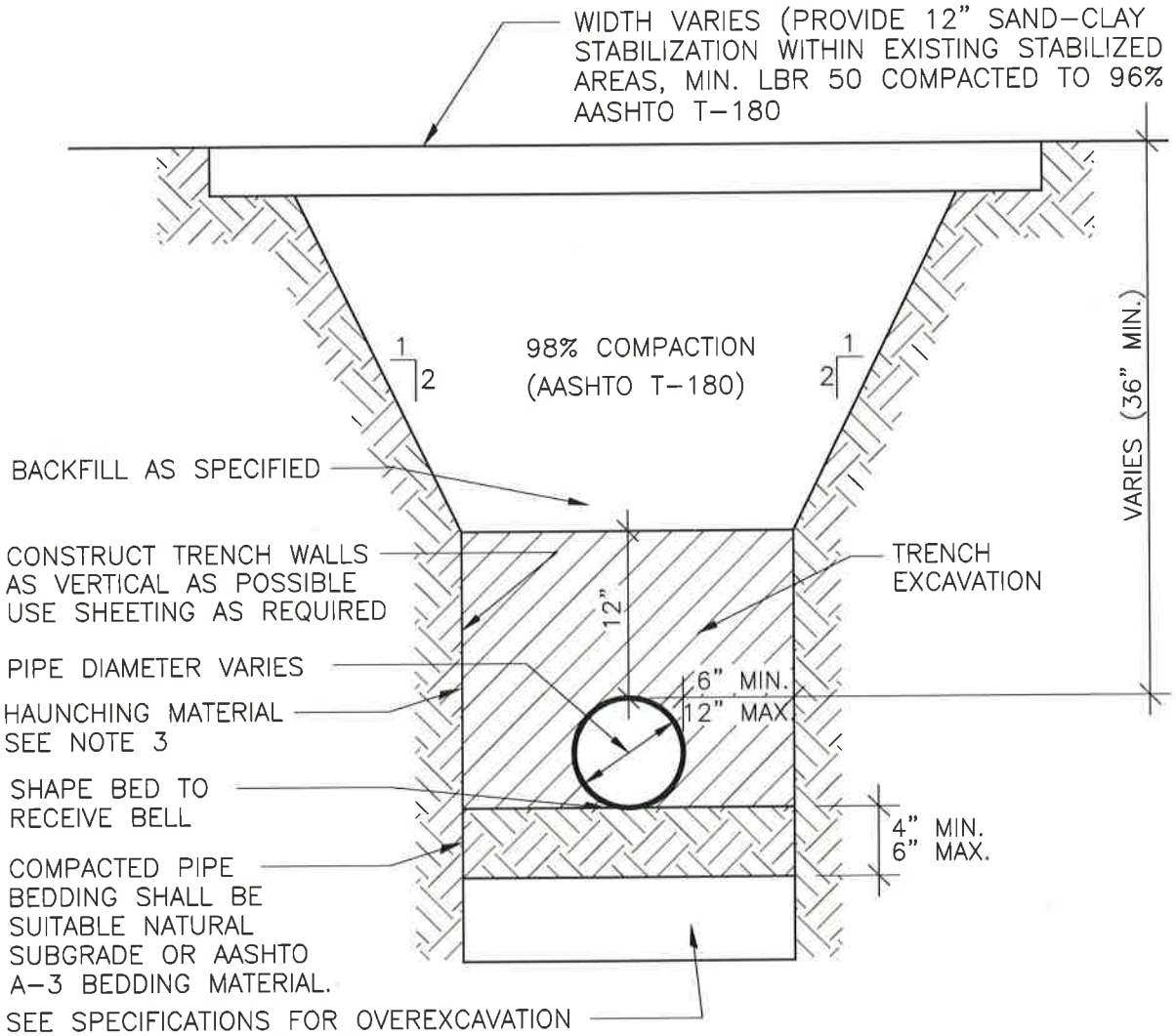


FULL CONCRETE ENCASEMENT
3000 P.S.I. CONCRETE



TOWN OF HILLIARD
Standard Specifications for Utility Construction
Typical Concrete Encasement
Nassau County, Florida

FIGURE
S-11
March 2022
Project No.
9610-23-1
(Standards)

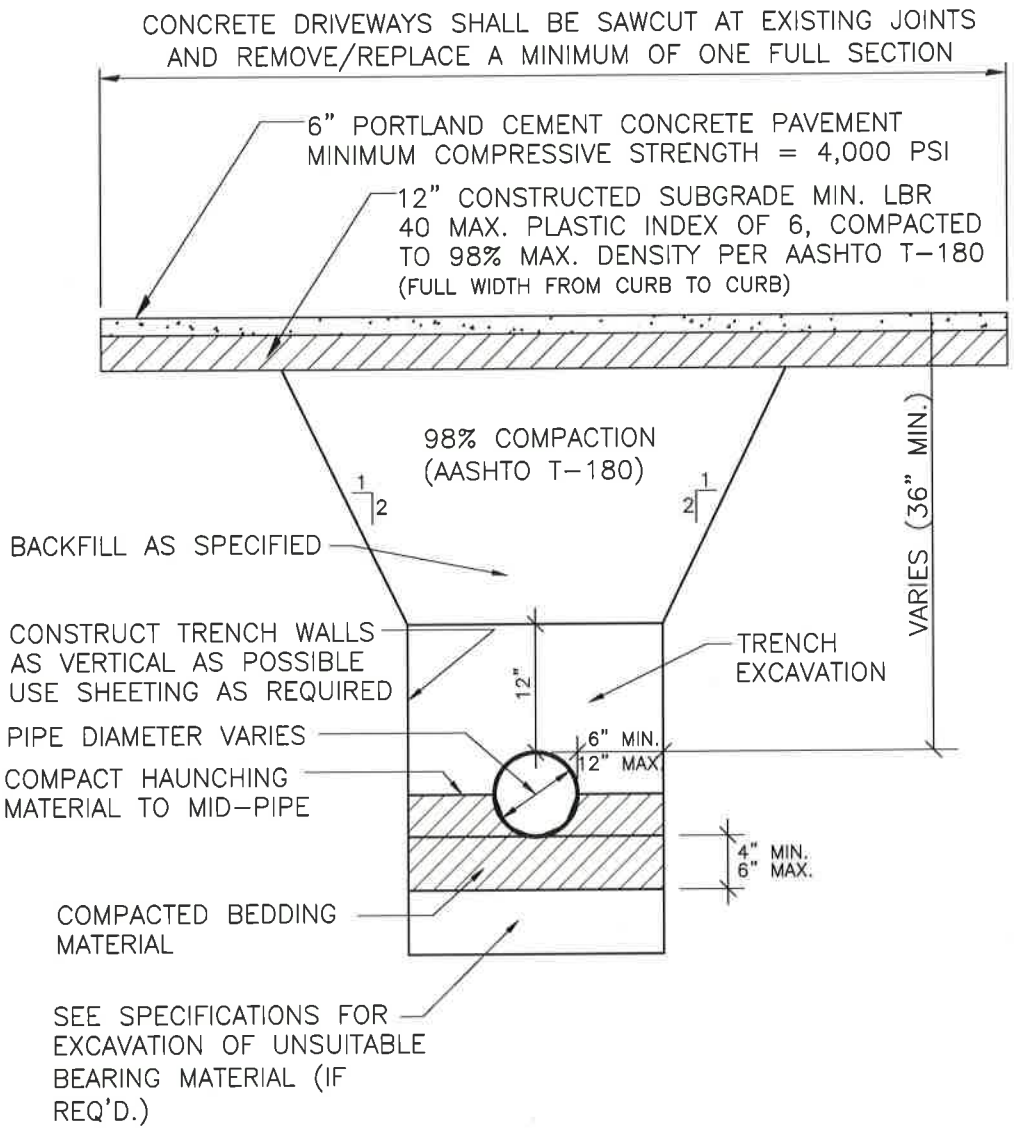


NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. PIPE INSTALLATION SHALL MEET THE REQUIREMENTS OF AWWA C–605 TYPE 4 LAYING CONDITION AND AS MODIFIED BY THIS DETAIL.
3. HAND COMPACT HAUNCHING MATERIAL IN 6" LIFTS COMPACTED TO 95% OF THE MAXIMUM DENSITY PER AASHTO T–180 TO 12 INCH ABOVE TOP OF PIPE.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail
Nassau County, Florida

FIGURE
S–12
March 2022
Project No.
9610–23–1
(Standards)



NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. MAXIMUM WIDTH OF REPLACEMENT SHALL BE 10 FT. OR TO NEAREST EXISTING JOINT, WHICHEVER IS LESS
3. PROVIDE SAW CUT CONTROL JOINTS AT 10' C-C EACH WAY

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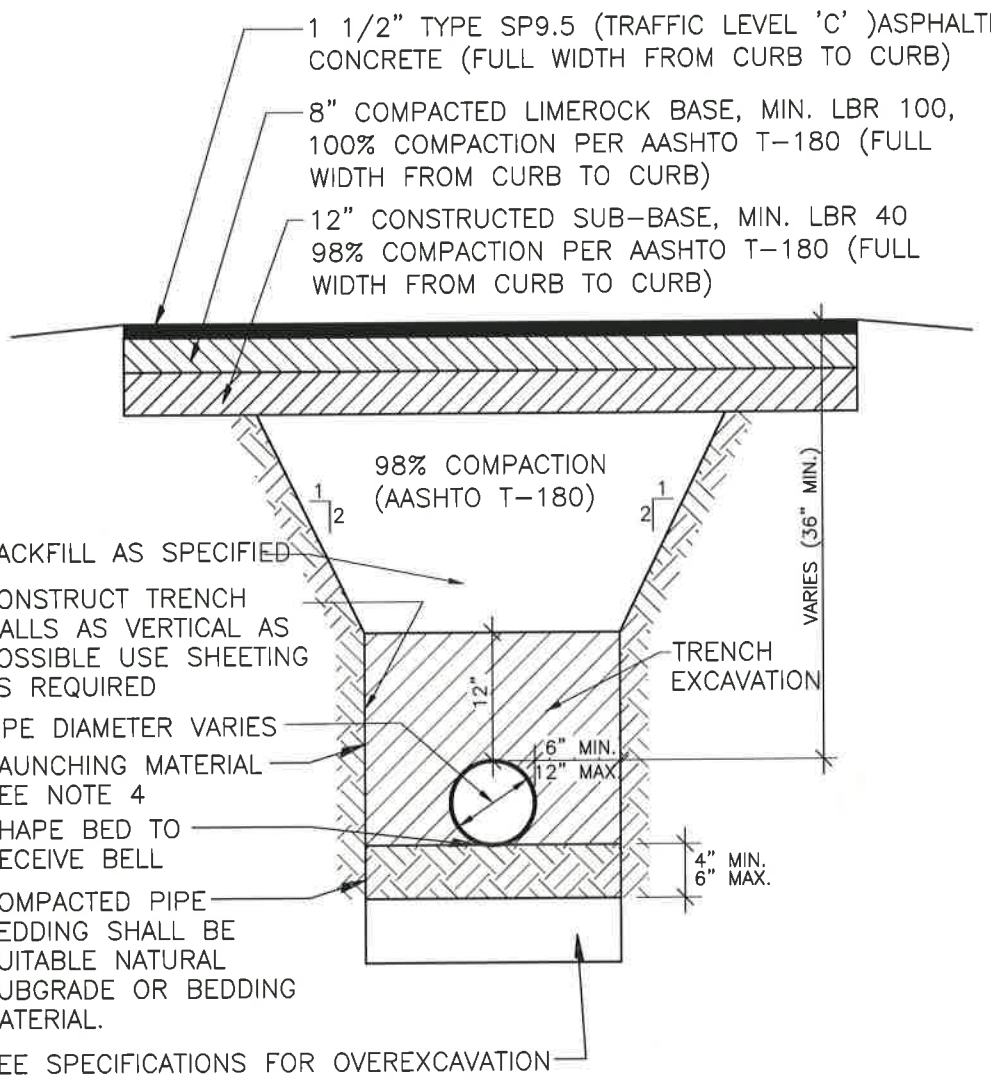
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail in Concrete Roadways
Nassau County, Florida

FIGURE
S-13
March 2022
Project No.
9610-23-1
(Standards)

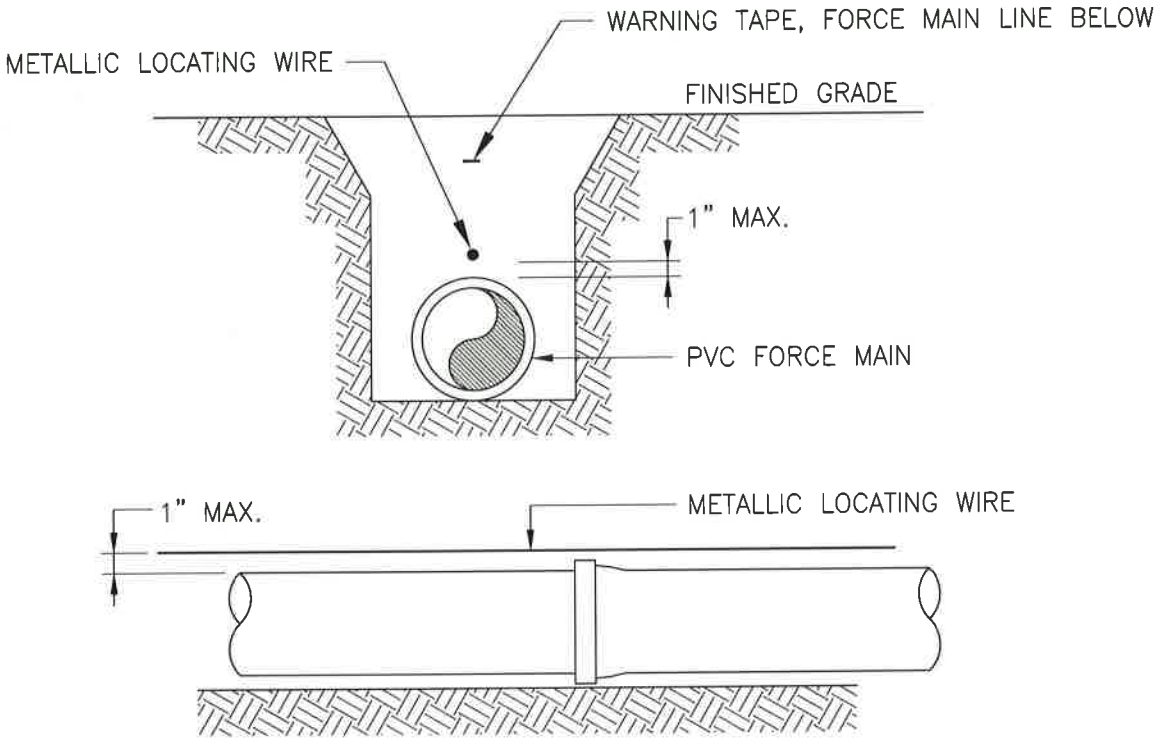


NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. SURFACE TREATED PAVEMENT JOINTS SHALL BE LAPPED AND FEATHERED.
3. PIPE INSTALLATION SHALL MEET THE REQUIREMENTS OF AWWA C-600 TYPE 2 LAYING CONDITION AND AS MODIFIED BY THIS DETAIL.
4. COMPACT HAUNCHING MATERIAL IN 6" LIFTS COMPACTED TO 98% OF THE MAXIMUM DENSITY PER AASHTO T-180 TO 12 INCH ABOVE TOP OF PIPE.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail in Asphalt Roadways
Nassau County, Florida

FIGURE
S-14
March 2022
Project No.
9610-23-1
(Standards)

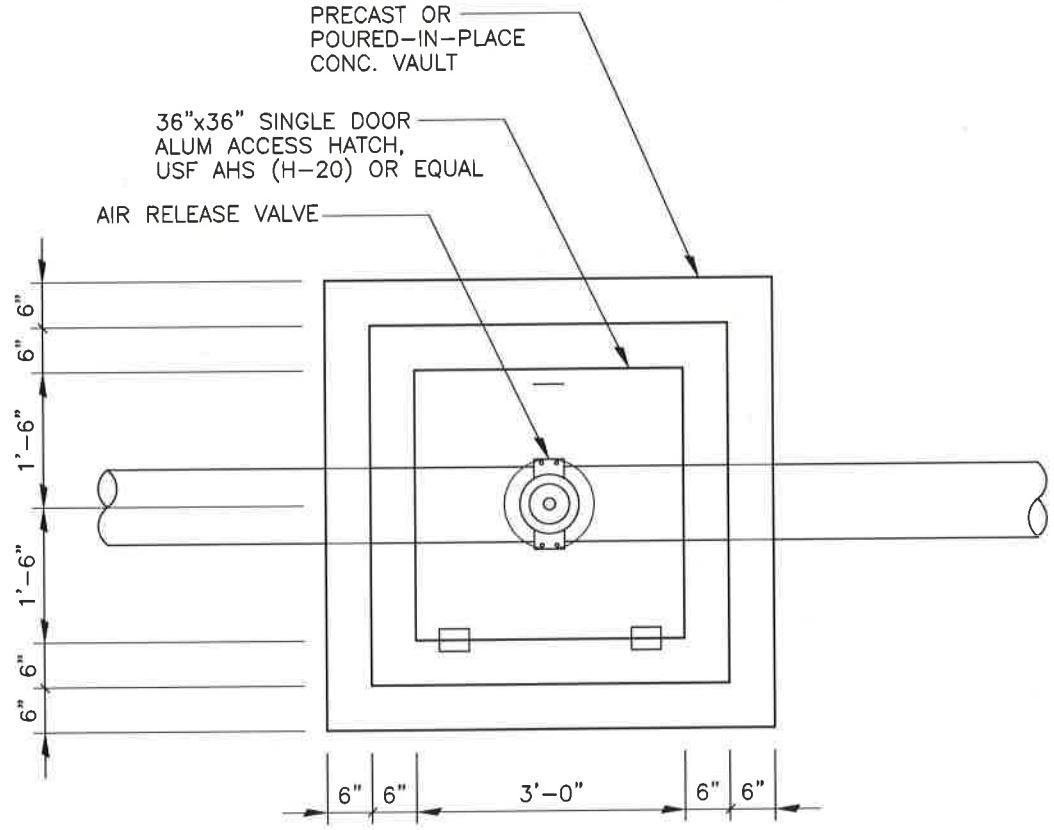


NOTES:

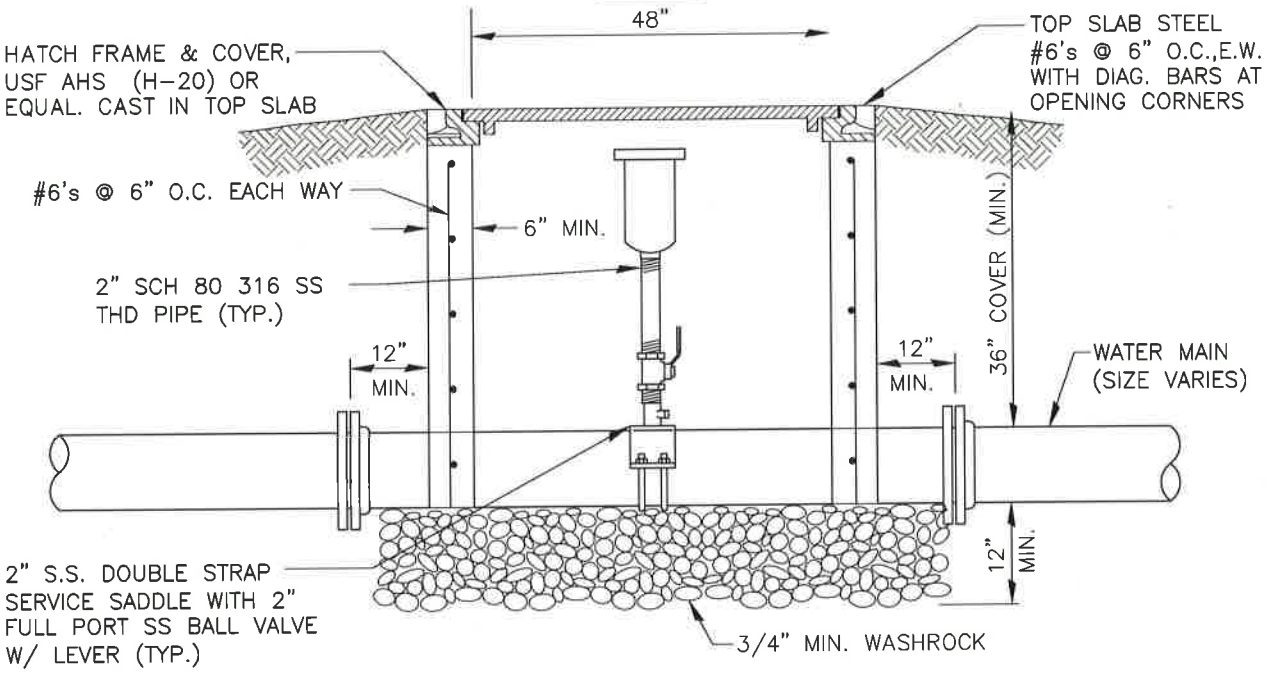
1. ALL PVC FORCE MAIN SHALL REQUIRE INSULATED METALLIC LOCATING WIRE (12 GAUGE, SOLID STRAND COPPER W/TYPE UF INSULATION) CAPABLE OF DETECTION BY A CABLE LOCATOR
2. WIRE SHALL BE ATTACHED TO THE TOP OF PIPE WITH DUCT TAPE, A MINIMUM OF THREE TIMES PER JOINT OF PIPE. LOCATING WIRE SHALL TERMINATE AT THE TOP OF EACH VALVE BOX
3. PROVIDE WIRE LENGTH CAPABLE OF EXTENDING 12" ABOVE TOP OF VALVE BOX IN SUCH A MANNER SO AS NOT TO INTERFERE WITH VALVE OPERATION.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locating Wire and Warning Tape Detail
Nassau County, Florida

FIGURE
S–15
March 2022
Project No.
9610–23–1
(Standards)



PLAN



SECTION

NOTES:

1. 4000 P.S.I., CONCRETE.
2. VAULT SHALL BE PRECAST OR POURED IN PLACE CONCRETE ALL WITH STEEL REINFORCING. BOX MAY HAVE SLOTTED BOTTOM (I.E. DOGHOUSE) TO ALLOW BOX TO BE SET OVER PIPE.

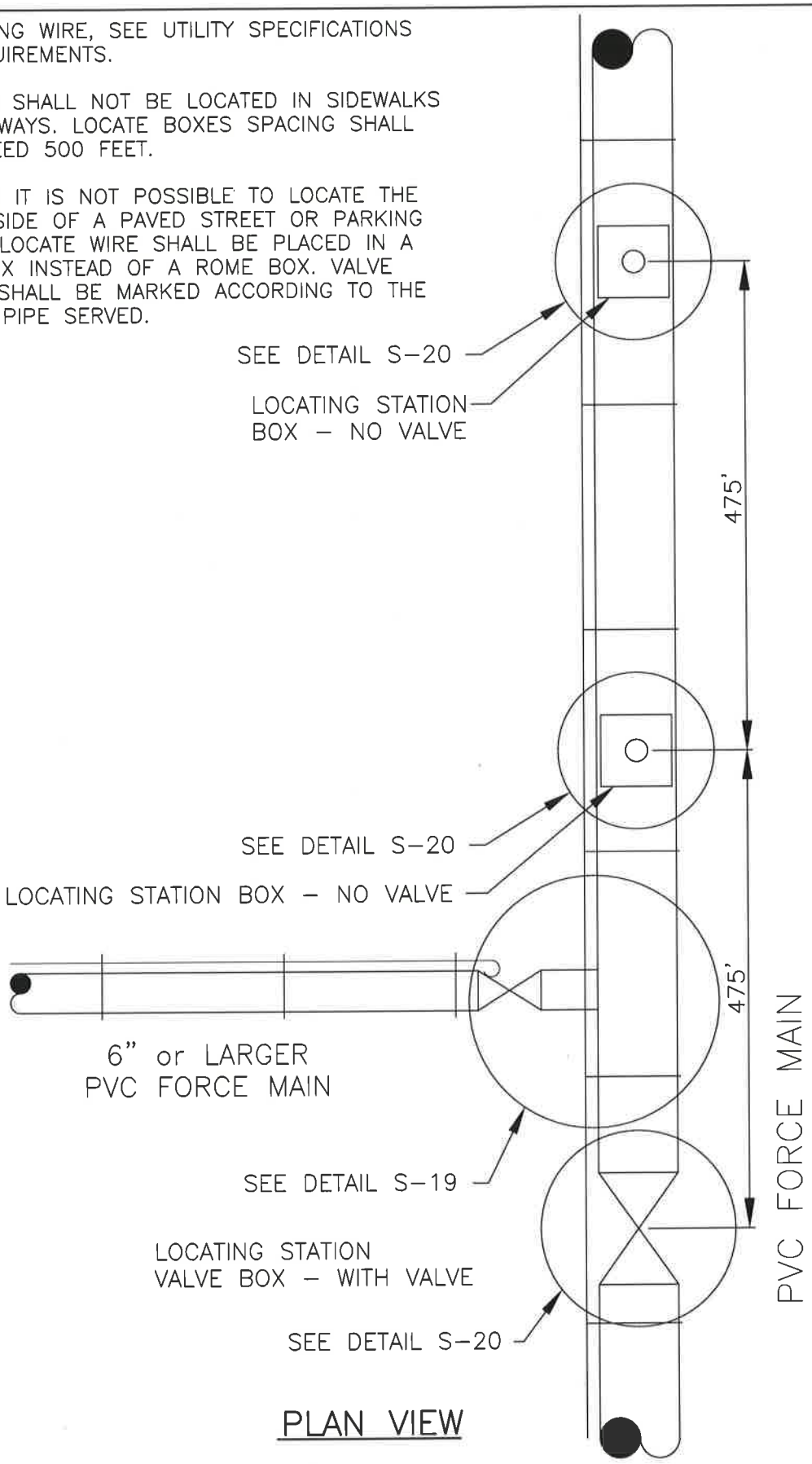
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Air Release Valve
Nassau County, Florida

FIGURE
S-16
March 2022
Project No.
9610-23-1
(Standards)

1. LOCATING WIRE, SEE UTILITY SPECIFICATIONS FOR REQUIREMENTS.

2. BOXES SHALL NOT BE LOCATED IN SIDEWALKS OR DRIVEWAYS. LOCATE BOXES SPACING SHALL NOT EXCEED 500 FEET.

3. WHERE IT IS NOT POSSIBLE TO LOCATE THE BOX OUTSIDE OF A PAVED STREET OR PARKING LOT THE LOCATE WIRE SHALL BE PLACED IN A VALVE BOX INSTEAD OF A ROME BOX. VALVE BOX LID SHALL BE MARKED ACCORDING TO THE TYPE OF PIPE SERVED.



PLAN VIEW

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
S-17
March 2022
Project No.
9610-23-1
(Standards)

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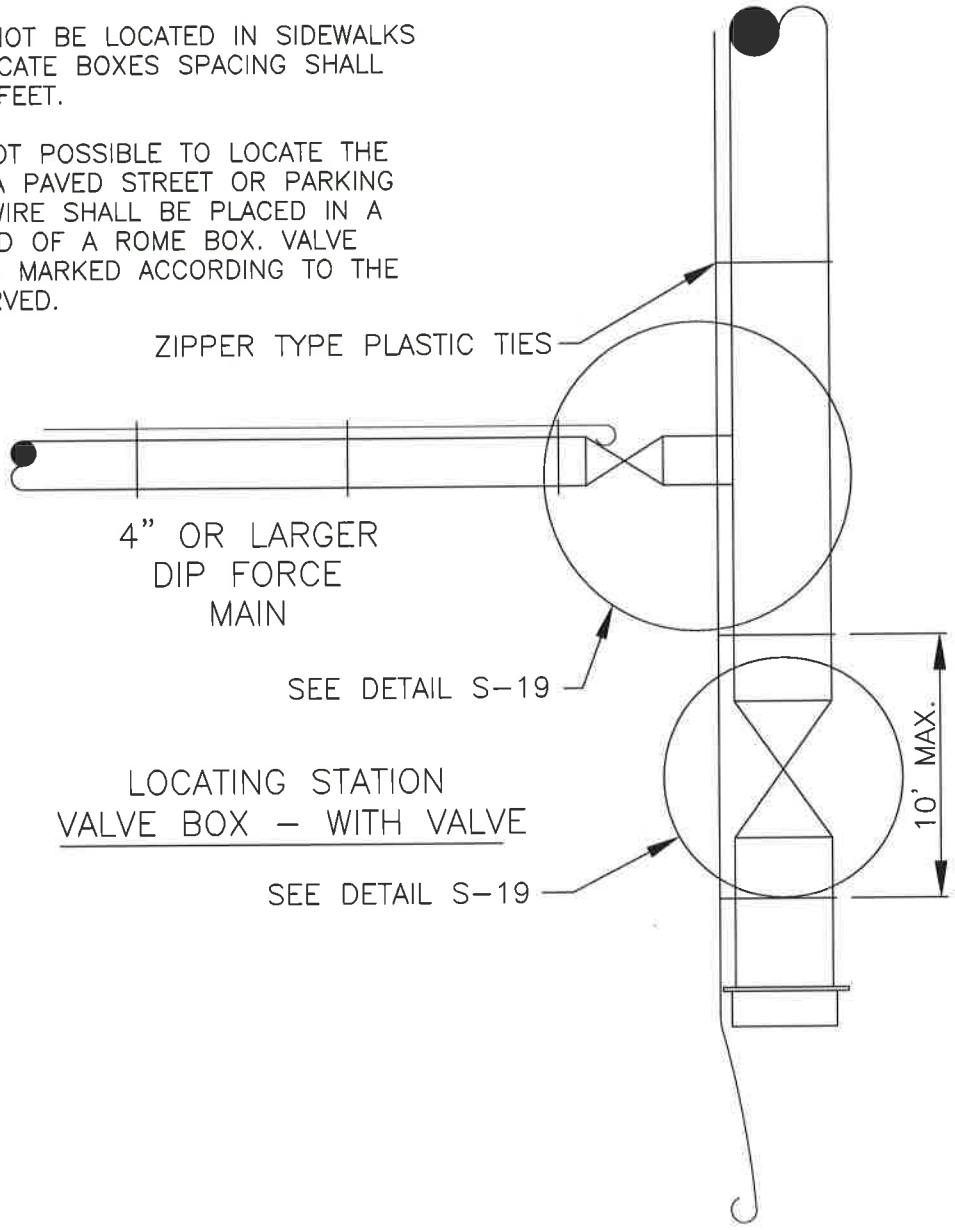
NOTES:

1. LOCATING WIRE, SEE UTILITY SPECIFICATIONS FOR REQUIREMENTS.

2. BOXES SHALL NOT BE LOCATED IN SIDEWALKS OR DRIVEWAYS. LOCATE BOXES SPACING SHALL NOT EXCEED 500 FEET.

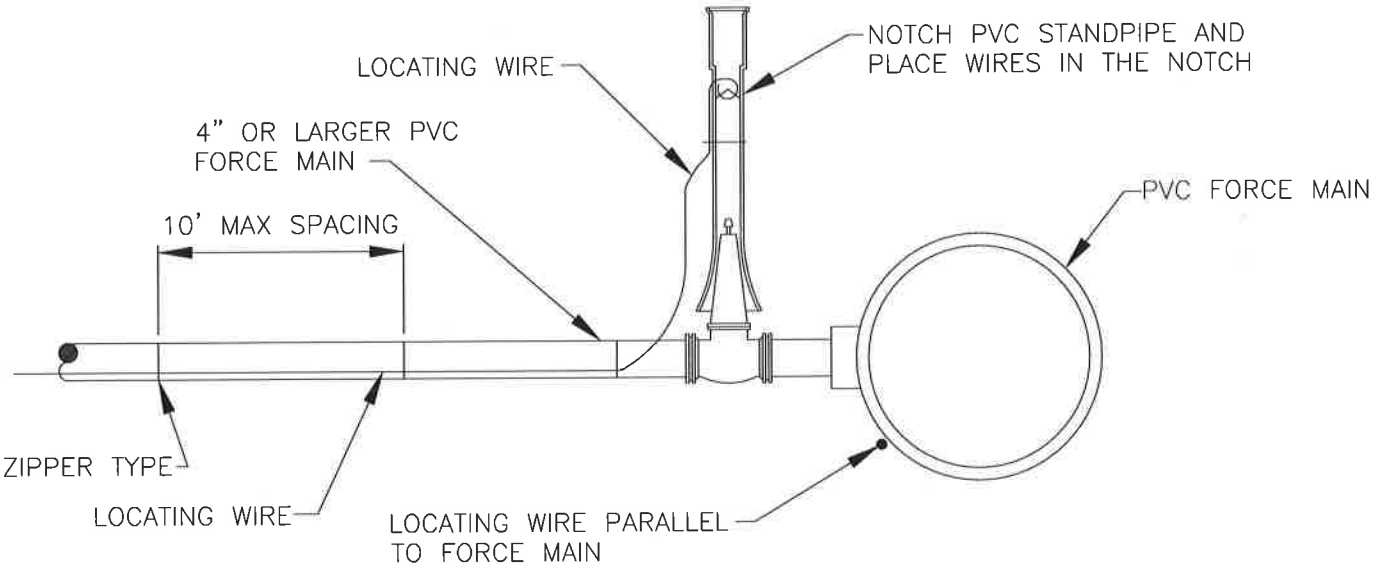
3. WHERE IT IS NOT POSSIBLE TO LOCATE THE BOX OUTSIDE OF A PAVED STREET OR PARKING LOT THE LOCATE WIRE SHALL BE PLACED IN A VALVE BOX INSTEAD OF A ROME BOX. VALVE BOX LID SHALL BE MARKED ACCORDING TO THE TYPE OF PIPE SERVED.



PLAN VIEW

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

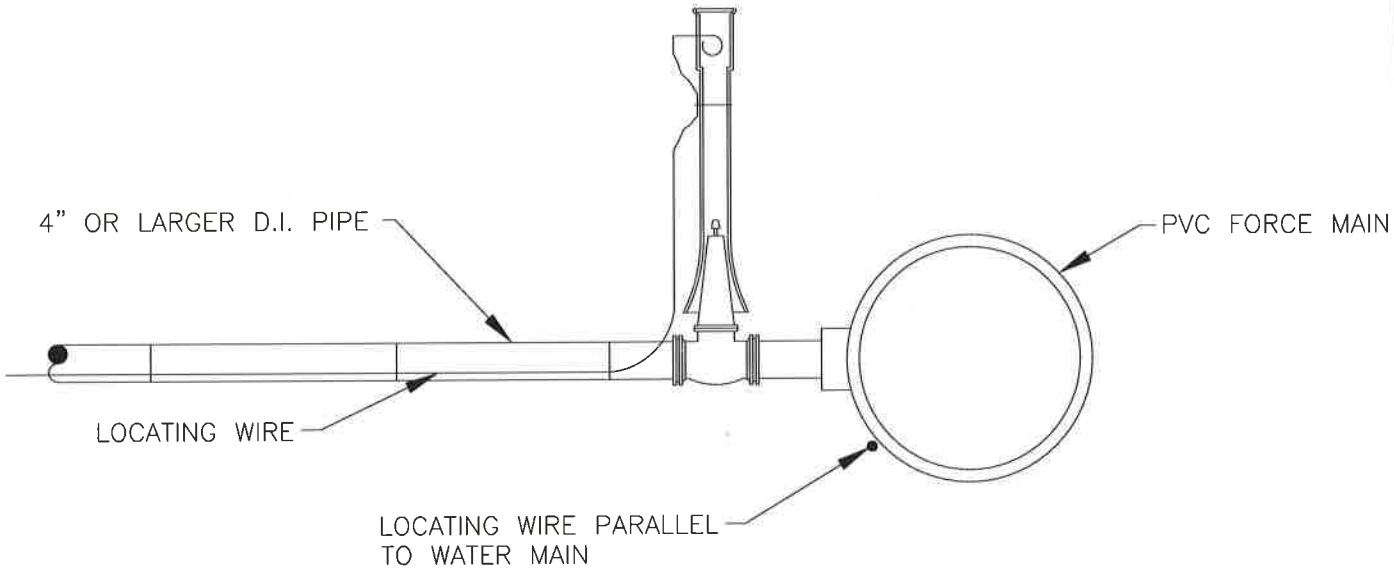
FIGURE
S-18
March 2022
Project No.
9610-23-1
(Standards)



CONNECTION TO PVC MAINS

4" OR LARGER PVC FORCE MAIN

DETAIL – A



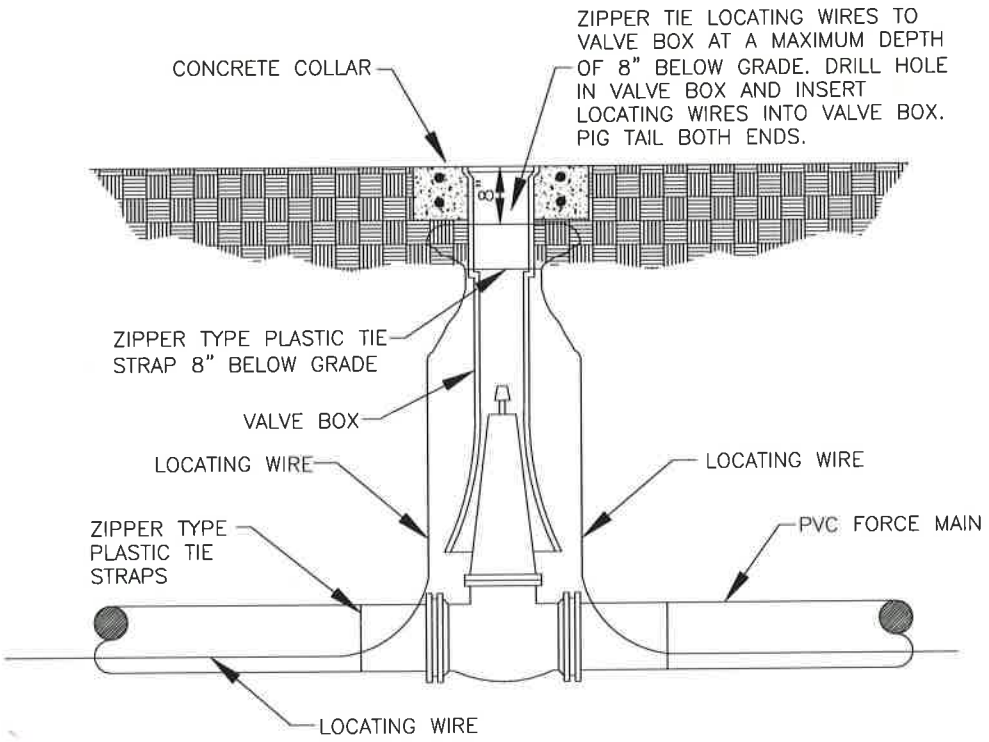
CONNECTION TO D.I. MAINS

w/4" OR LARGER D.I. FORCE MAIN

DETAIL – B

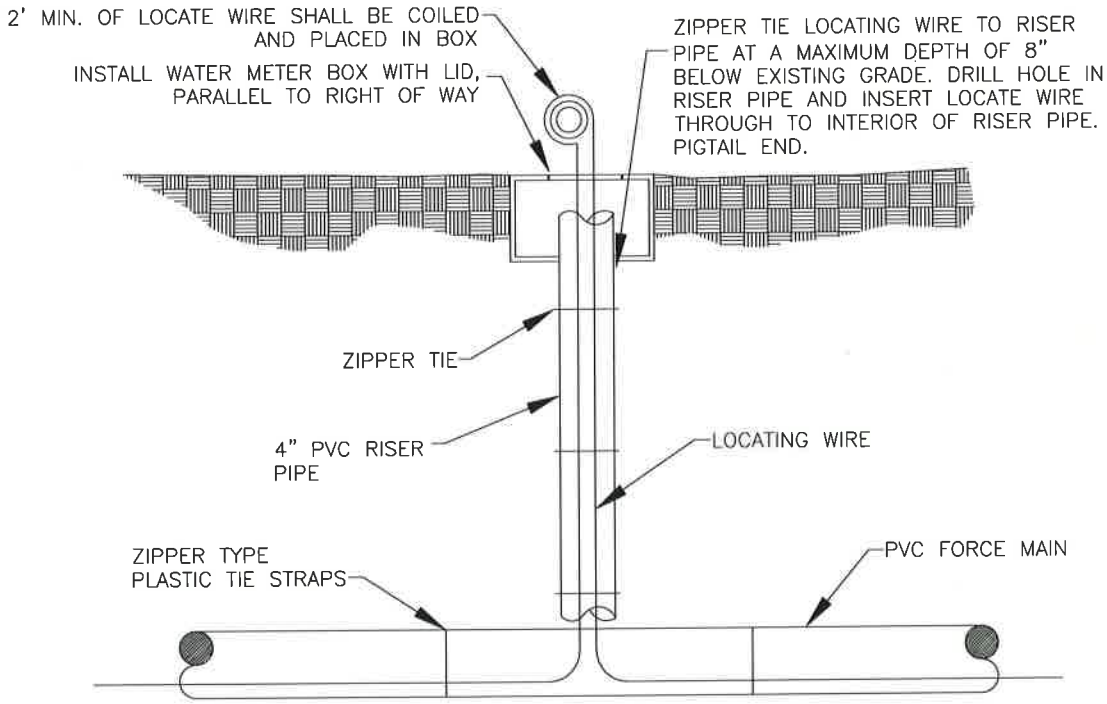
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
S–19
March 2022
Project No.
9610–23–1
(Standards)



IN LINE LOCATING STATION– PVC PIPE

VALVE BOX WITH VALVE

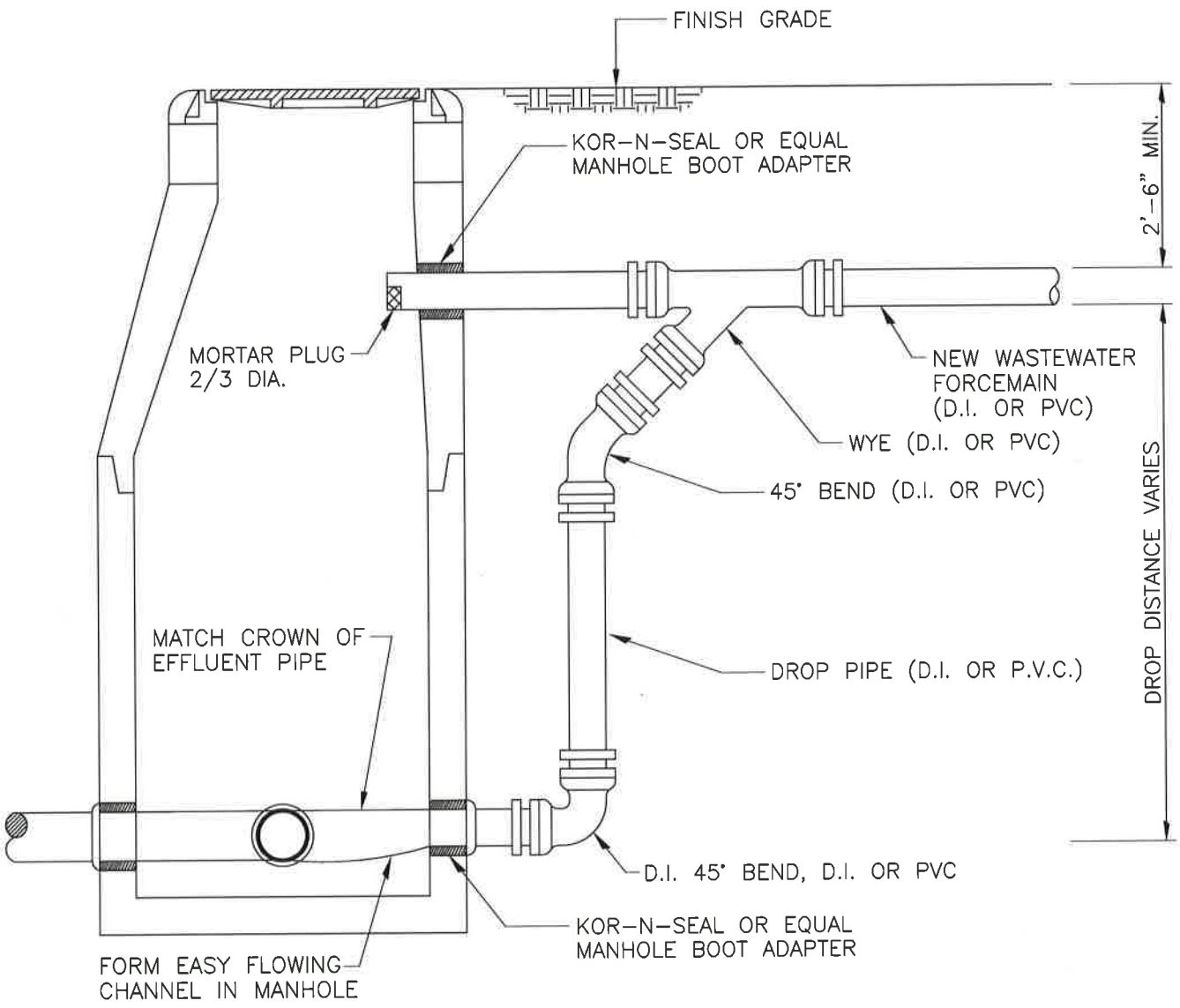


IN LINE LOCATING STATION – PVC PIPE

METER BOX

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
S–20
March 2022
Project No.
9610–23–1
(Standards)

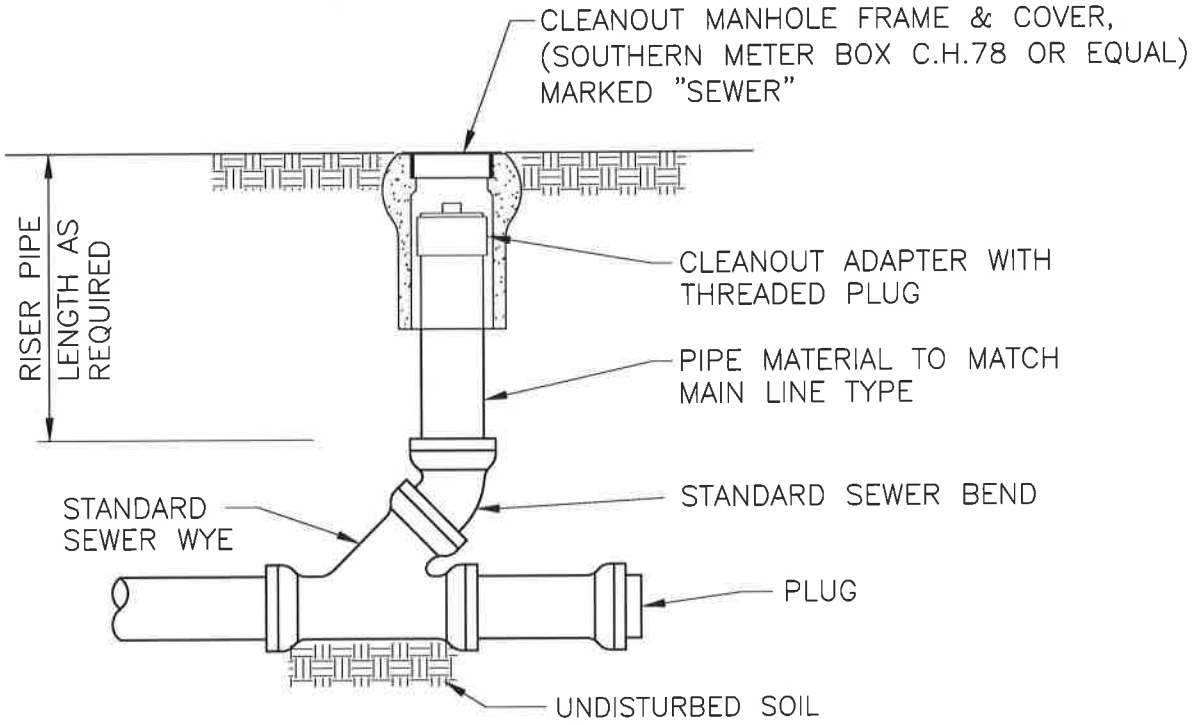


NOTES:

1. IF DROP IS EQUAL TO OR LESS THAN 2.0', CONTRACTOR MAY INSTALL 45° BENDS IN LIEU OF WYE, DROP PIPE AND 90° BEND AT HIS OPTION.
2. IF FORCE MAIN <3" DIA., CONNECT FORCE MAIN AT MANHOLE INVERT USING 45° BENDS AND ELIMINATE UPPER MANHOLE PENETRATION.

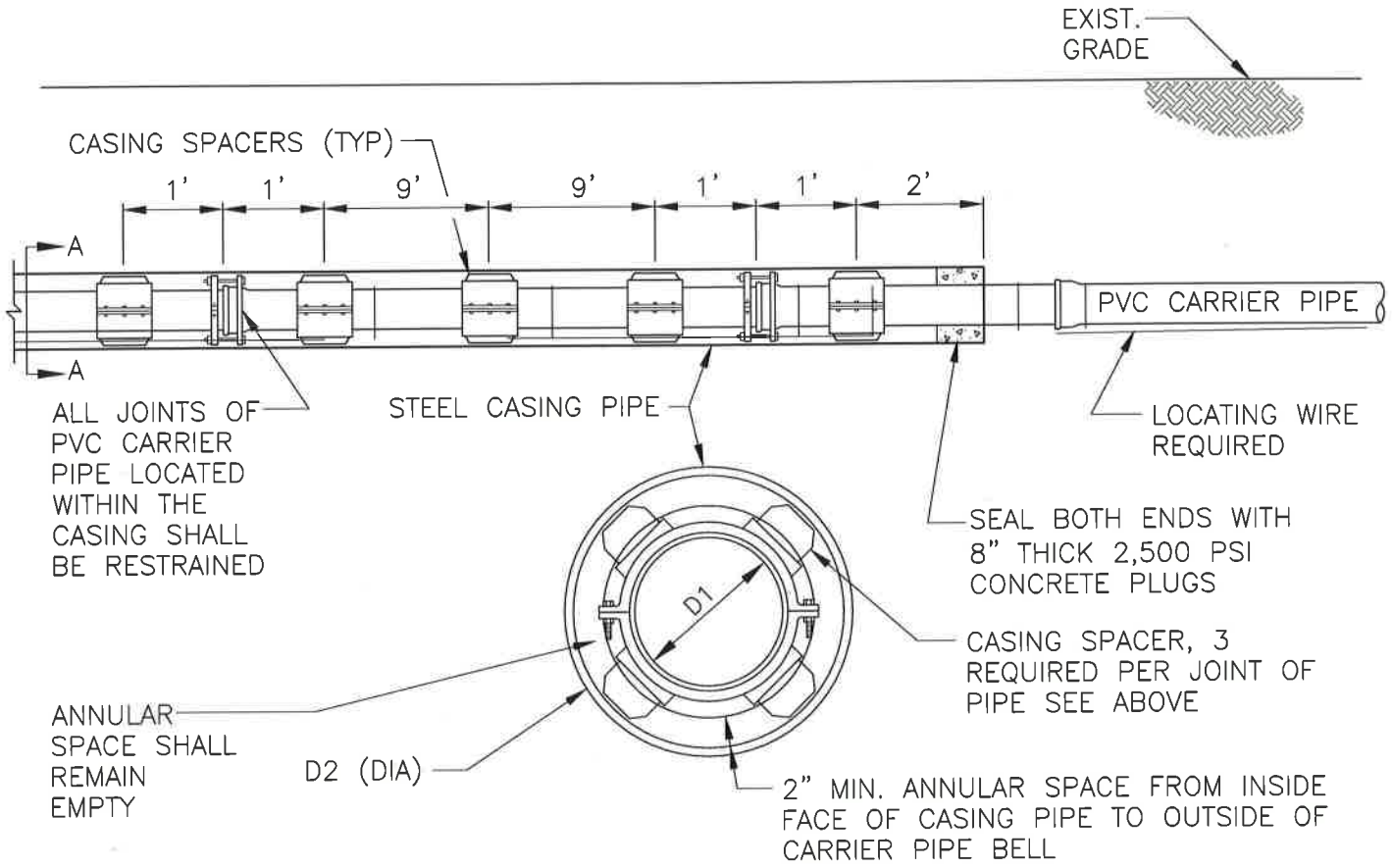
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Force Main Connection to Manhole Detail
Nassau County, Florida

FIGURE
S-21
March 2022
Project No.
9610-23-1
(Standards)



TOWN OF HILLIARD
Standard Specifications for Utility Construction
Sewer Cleanout Detail
Nassau County, Florida

FIGURE
S–22
March 2022
Project No.
9610–23–1
(Standards)



SECTION "A–A"

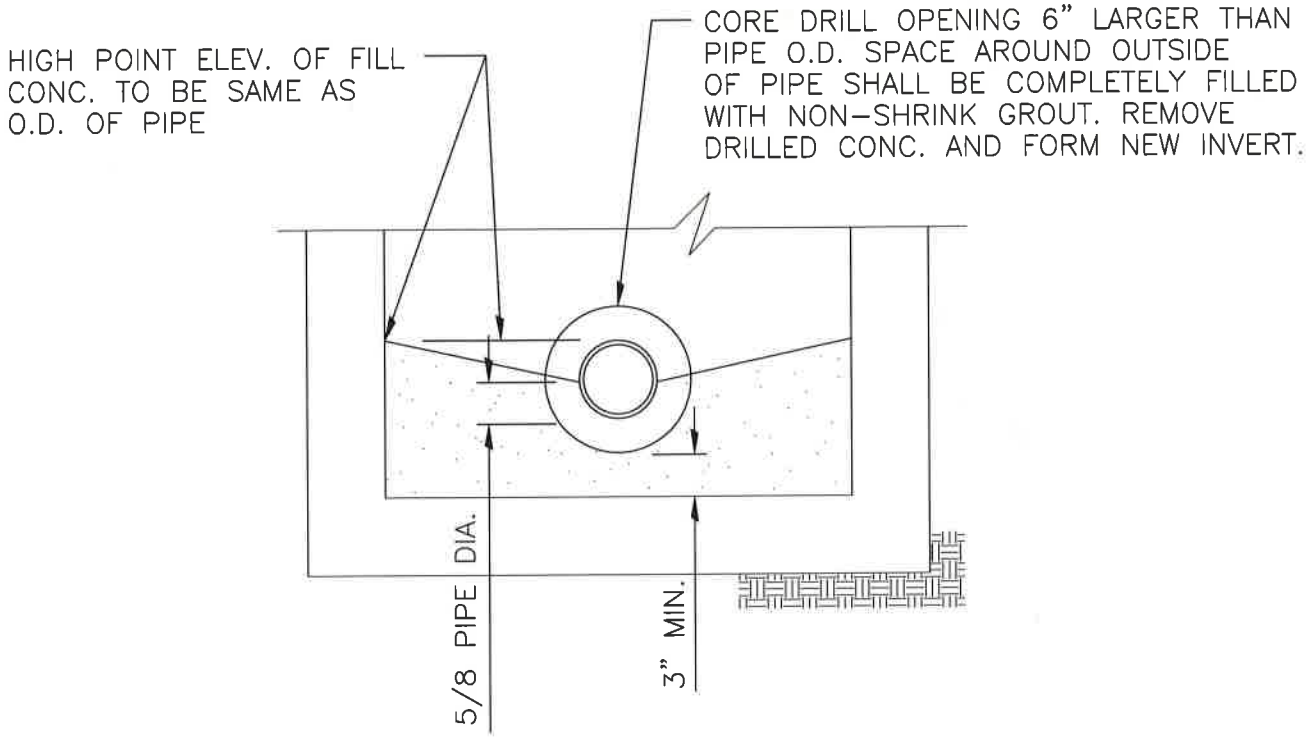
	CARRIER PIPE AND CASING PIPE SIZES (MIN.) IN INCHES											
CARRIER PIPE NOM. DIA. (D_1)	4	6	8	10	12	14	16	18	20	24	30	36
CASING PIPE NOM. DIA (D_2)	14	16	20	24	24	30	30	36	36	42	48	54
D.O.T. WALL THICKNESS	0.25	0.25	0.25	0.25	0.25	0.312	0.312	0.375	0.375	0.50	0.50	0.50

NOTES:

1. THE INSIDE DIAMETER OF THE CASING PIPE SHALL BE A MINIMUM OF 4–INCHES GREATER THAN THE OUTSIDE DIAMETER OF THE CARRIER PIPE BELL OR RESTRAINER COUPLING.
2. ALL PVC CARRIER PIPE JOINTS WITHIN CASING PIPE SHALL BE MECHANICAL RESTRAINED JOINTS.
3. FOR STREET USES WHICH ARE NOT D.O.T., USE D.O.T. CASING THICKNESS UNLESS OTHERWISE INDICATED BY ENGINEER.
4. CASING PIPE SHALL BE FURNISHED IN NOMINAL 8–FOOT LENGTHS (MIN.) UNLESS OTHERWISE INDICATED ON THE DRAWING.
5. CASING PIPE SHALL CONFORM TO EITHER ASTM STANDARD A139 FOR "ELECTRIC FUSION (ARC) WELDED STEEL PIPE". WITH A SPECIFIED MINIMUM YIELD STRENGTH (SMYS) OF 35,000 PSI OR "API SPECIFICATION API–5LX, GRADE X–42 WELDED STEEL PIPE".

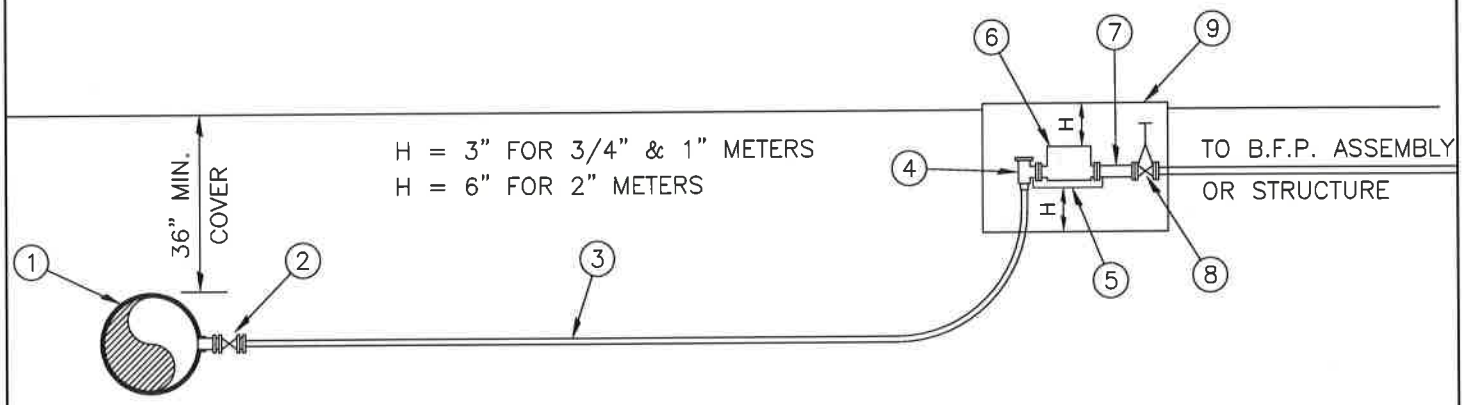
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Jack and Bore Detail
Nassau County, Florida

FIGURE
S–23
March 2022
Project No.
9610–23–1
(Standards)



TOWN OF HILLIARD
Standard Specifications for Utility Construction
Connection to Existing Manhole
Nassau County, Florida

FIGURE
S-24
March 2022
Project No.
9610-23-1
(Standards)



COMPONENT / SERVICE	1 BRASS TAPPING SADDLE OR TEE	2 FORD–BRASS CORP. STOP	3 POLY–ETHYLENE	4 FORD–BRASS ANGLE YOKE VALVE	5 FORD METER YOKE
SINGLE POTABLE WATER SERVICE FOR 1" METER	1" (SMITH–BLAIR)	1" F1000 OR F1100	1"	AV94–324W 1" PJ/CTS	Y504
SINGLE POTABLE WATER SERVICE FOR 2" METER	2" (SMITH–BLAIR)	2" F1000 OR F1100	2"	FV63–77W 2" PJ/CTS	N/A

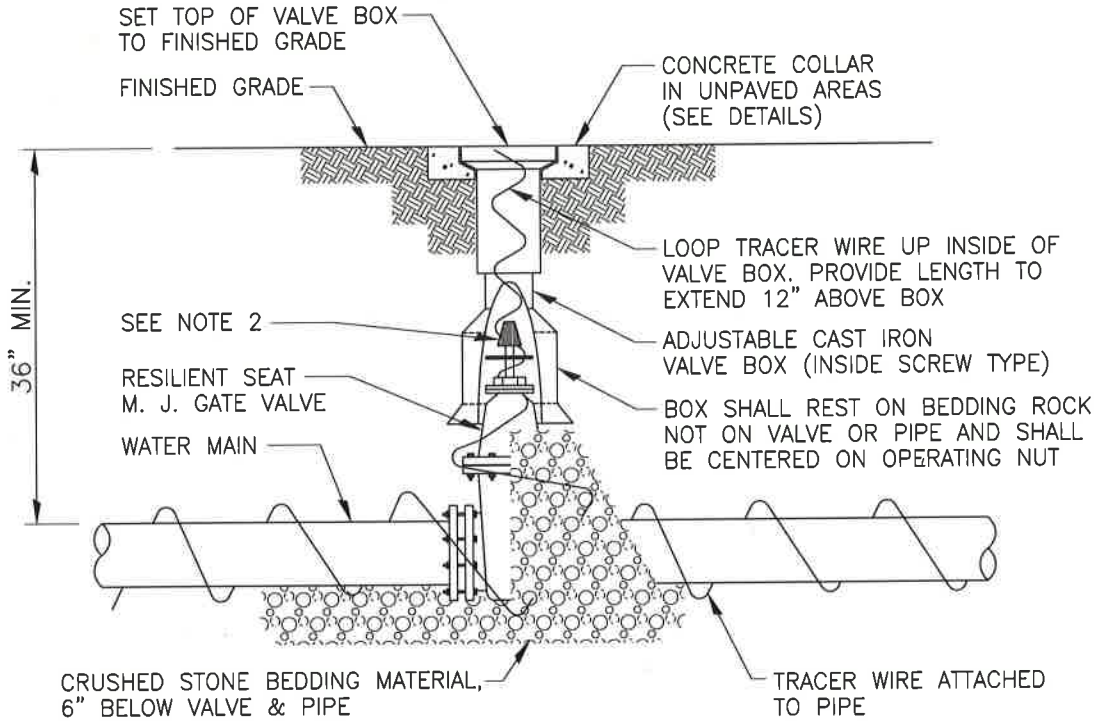
COMPONENT / SERVICE	6 METER	7 BRASS NIPPLE	8 RED & WHITE GATE VALVE W/ALUMINUM HANDWHEEL	9 BROOKS OR CDR METER BOX
SINGLE POTABLE WATER SERVICE FOR 1" METER	SEE SPECS	1" MIPT x MIPT 6" LONG	1"	#1324
SINGLE POTABLE WATER SERVICE FOR 2" METER	SEE SPECS	2" MIPT x MIPT 6" LONG	2"	#1324

NOTES:

1. POLYETHYLENE SHALL BE IN ACCORDANCE WITH ASTM 2737 AND AWWA C–901, SHALL BE SDR 11, AND RATED FOR 160 PSI SERVICE.
2. TUBING SHALL BE MARKED WITH SIZE, MANUFACTURERS NAME, WORKING PRESSURE, NATIONAL SANITATION FOUNDATION APPROVAL, A.S.T.M. SPECIFICATION AND PRODUCTION CODE. TUBING SHALL HAVE AN OUTSIDE DIAMETER EQUIVALENT TO THE OUTER DIAMETER OF COPPER TUBING.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Water Service Detail for 1" and 2" Meters
Nassau County, Florida

FIGURE
W–1
March 2022
Project No.
9610–23–1
(Standards)

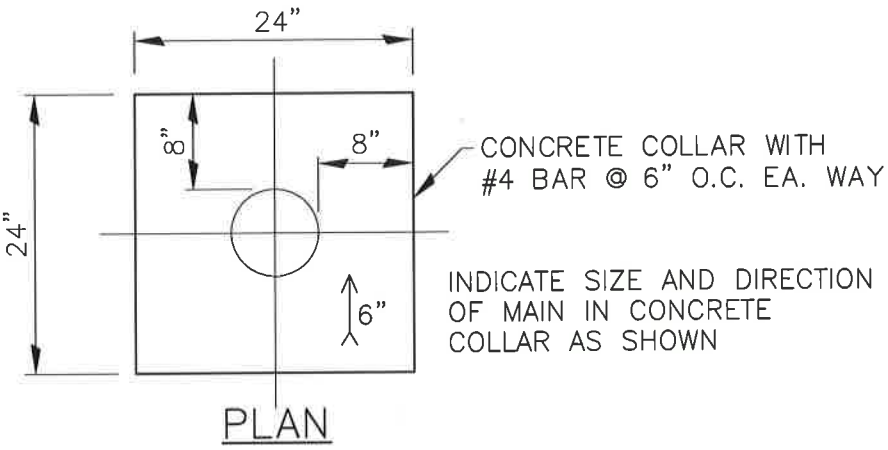


NOTES:

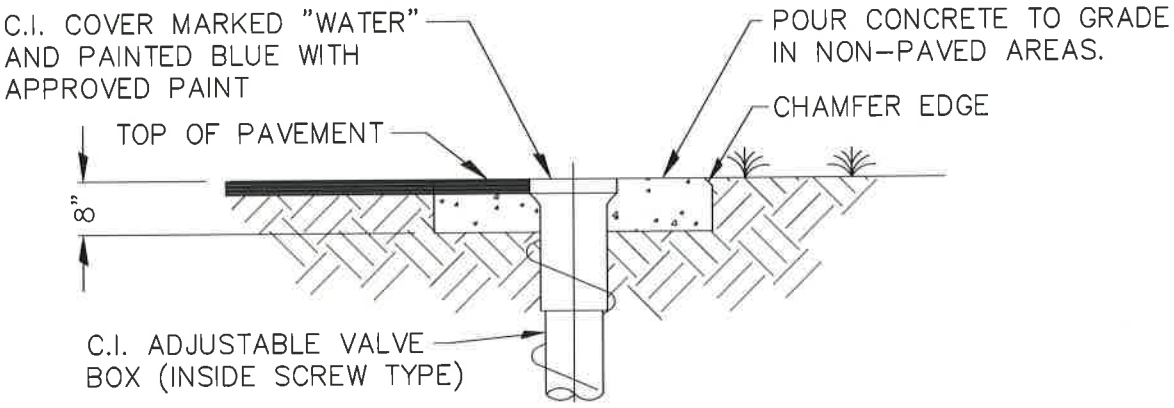
1. PVC EXTENSIONS SHALL NOT BE USED ON VALVE BOX INSTALLATION.
2. THE ACTUATING NUT FOR DEEPER VALVES SHALL BE EXTENDED TO A MAXIMUM OF 4 FEET BELOW FINISHED GRADE.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Gate Valve and Box Detail
Nassau County, Florida

FIGURE
W-2
March 2022
Project No.
9610-23-1
(Standards)



PLAN



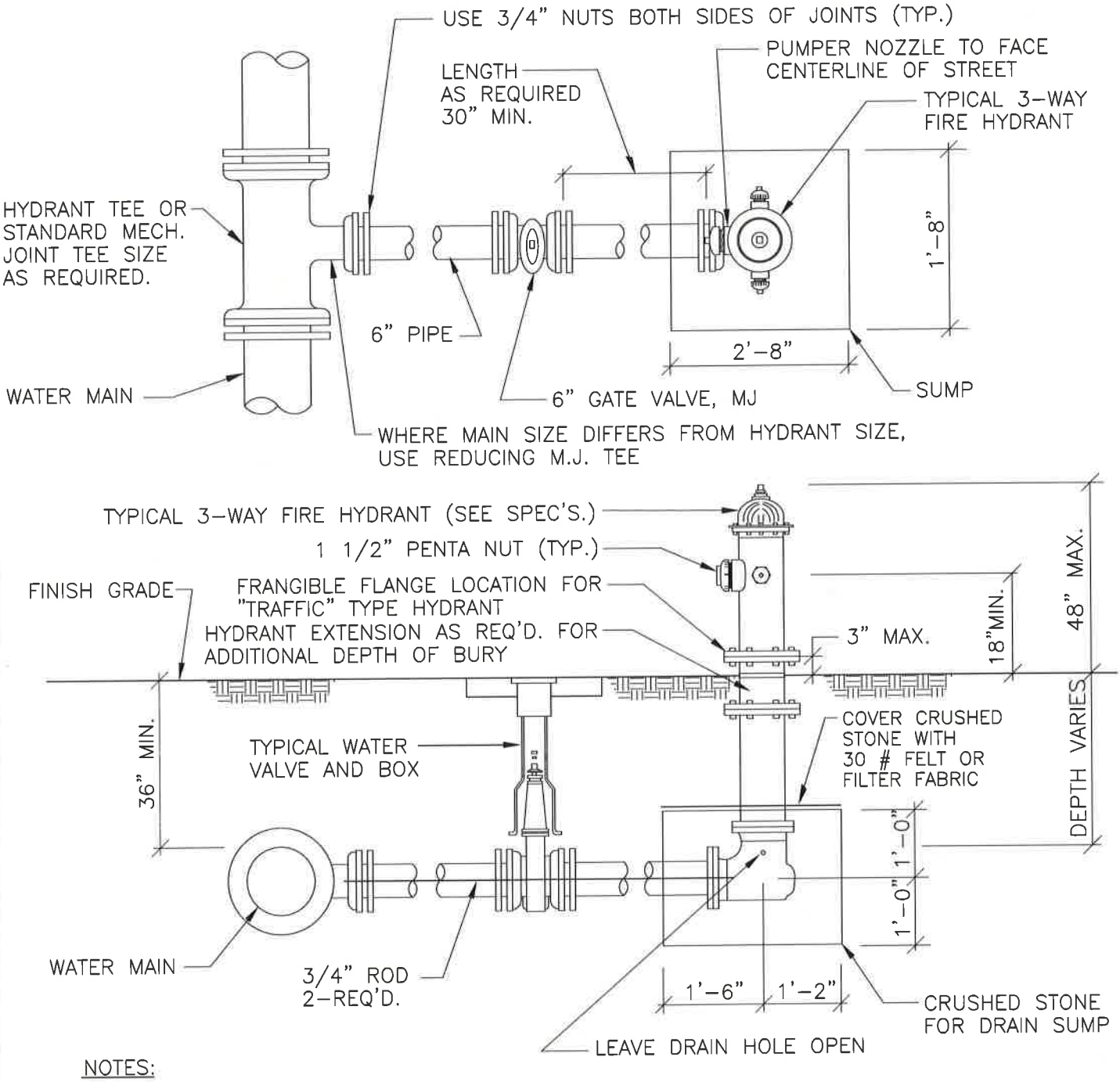
SECTION

NOTES:

1. CONCRETE COLLAR IS NOT REQUIRED IN PAVED AREAS IF PAVEMENT SURFACE IS FINISHED PRIOR TO CONDITIONAL FINAL INSPECTION.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Valve Collar Detail
Nassau County, Florida

FIGURE
W-3
March 2022
Project No.
9610-23-1
(Standards)

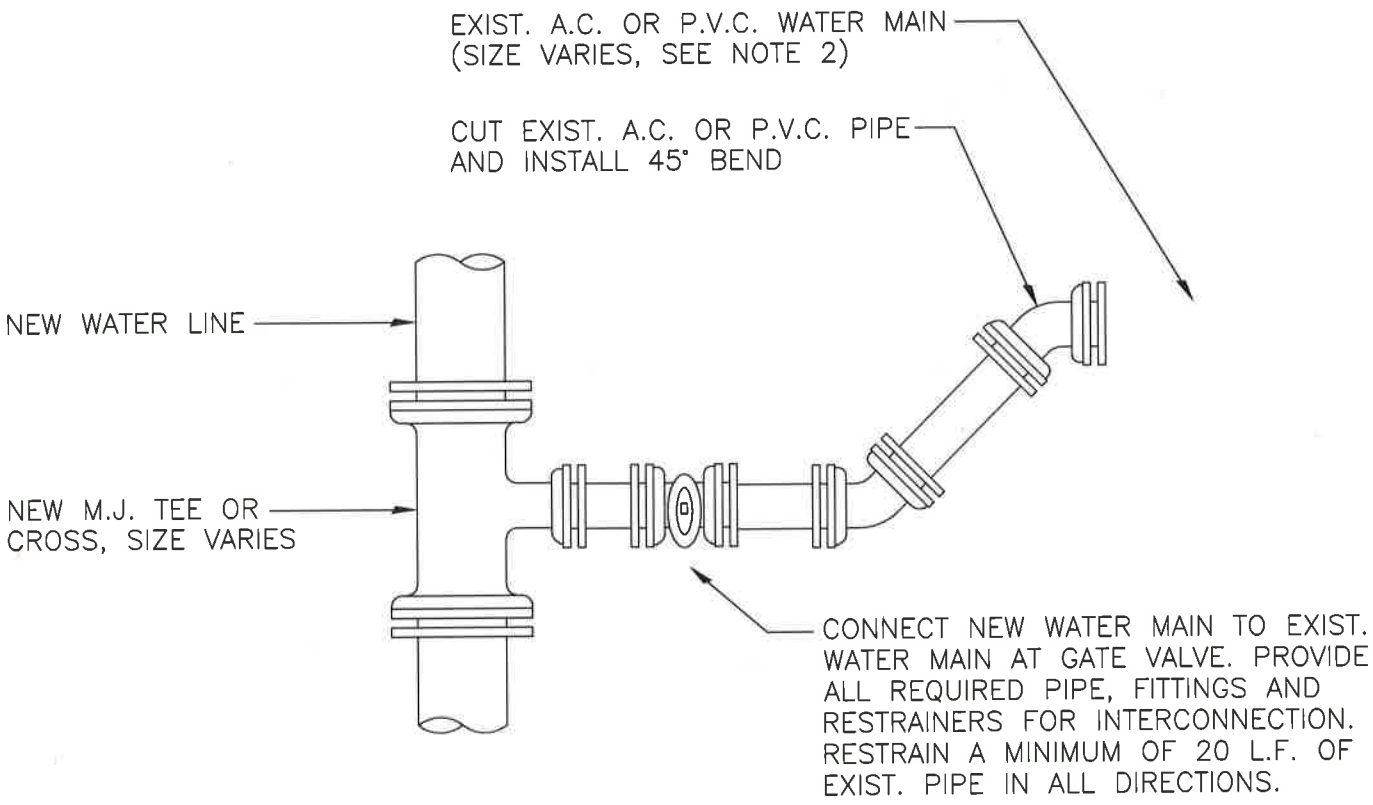


NOTES:

1. TIE RODS, NUTS, WASHERS AND OTHER FASTENERS SHALL BE ASTM A 246 CORROSION RESISTANT STEEL, GALVANIZED OR TYPE 316 STAINLESS STEEL.
2. ALL PIPE, VALVES AND FITTINGS OF HYDRANT SHALL BE RESTRAINED.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Typical Fire Hydrant Assembly Detail
Nassau County, Florida

FIGURE
W-4
March 2022
Project No.
9610-23-1
(Standards)



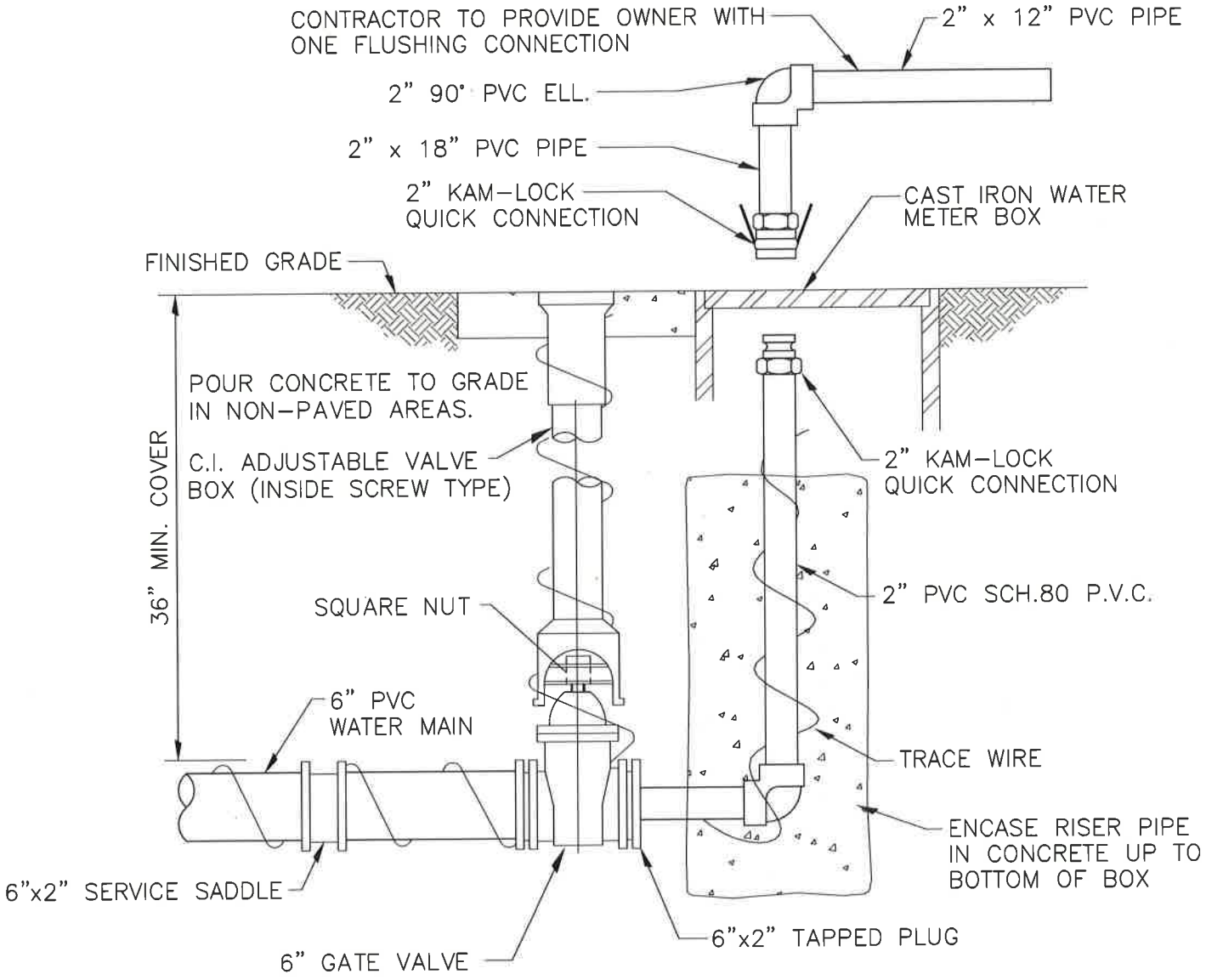
NOTES:

1. ALL PIPE, VALVES AND FITTINGS SHALL BE RESTRAINED IN ACCORDANCE WITH THE UTILITY STANDARDS.

2. THE CONTRACTOR/DEVELOPER SHALL PROVIDE ALL LINE STOP AND/OR INSERT-A-VALVE MECHANISMS AS REQUIRED TO ISOLATE THE TOWN'S SYSTEM PRIOR TO TIE-IN. THE TOWN DOES NOT WARRANTY ANY EXISTING PIPING CAN BE ISOLATED FOR CONNECTION.

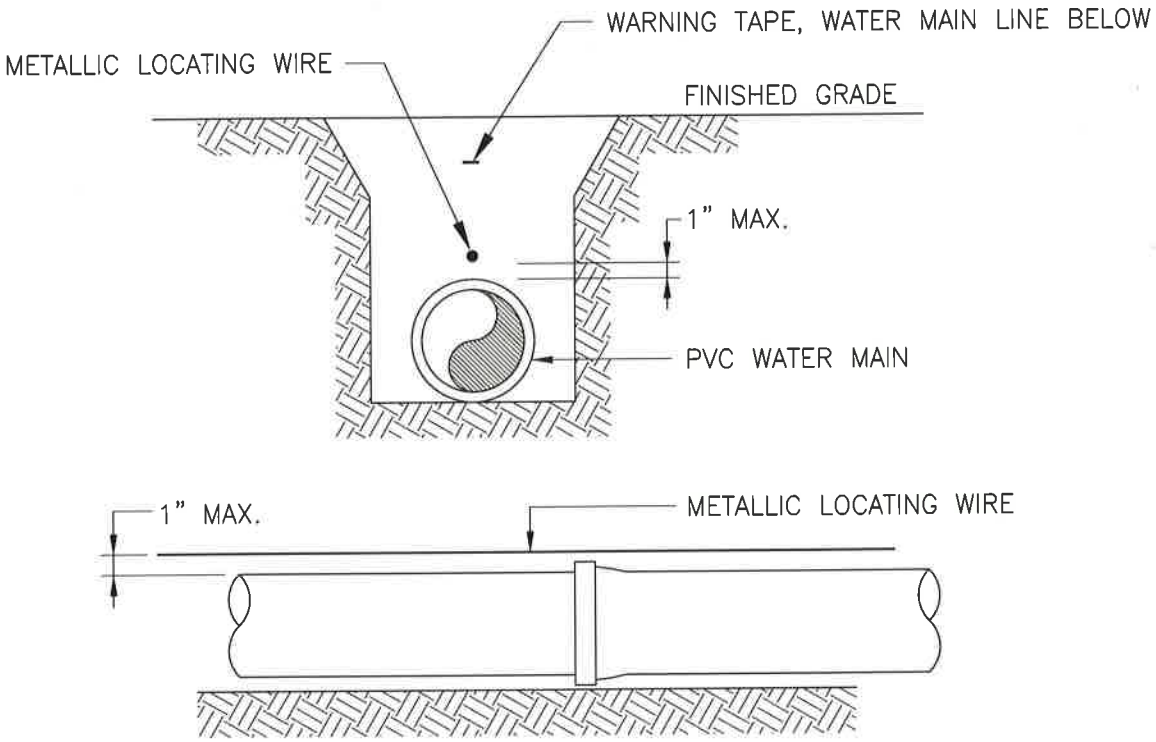
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Typical Existing Water Main Connection Detail
Nassau County, Florida

FIGURE
W-5
March 2022
Project No.
9610-23-1
(Standards)



TOWN OF HILLIARD
Standard Specifications for Utility Construction
Flushing Hydrant Assembly
Nassau County, Florida

FIGURE
W-6
March 2022
Project No.
9610-23-1
(Standards)

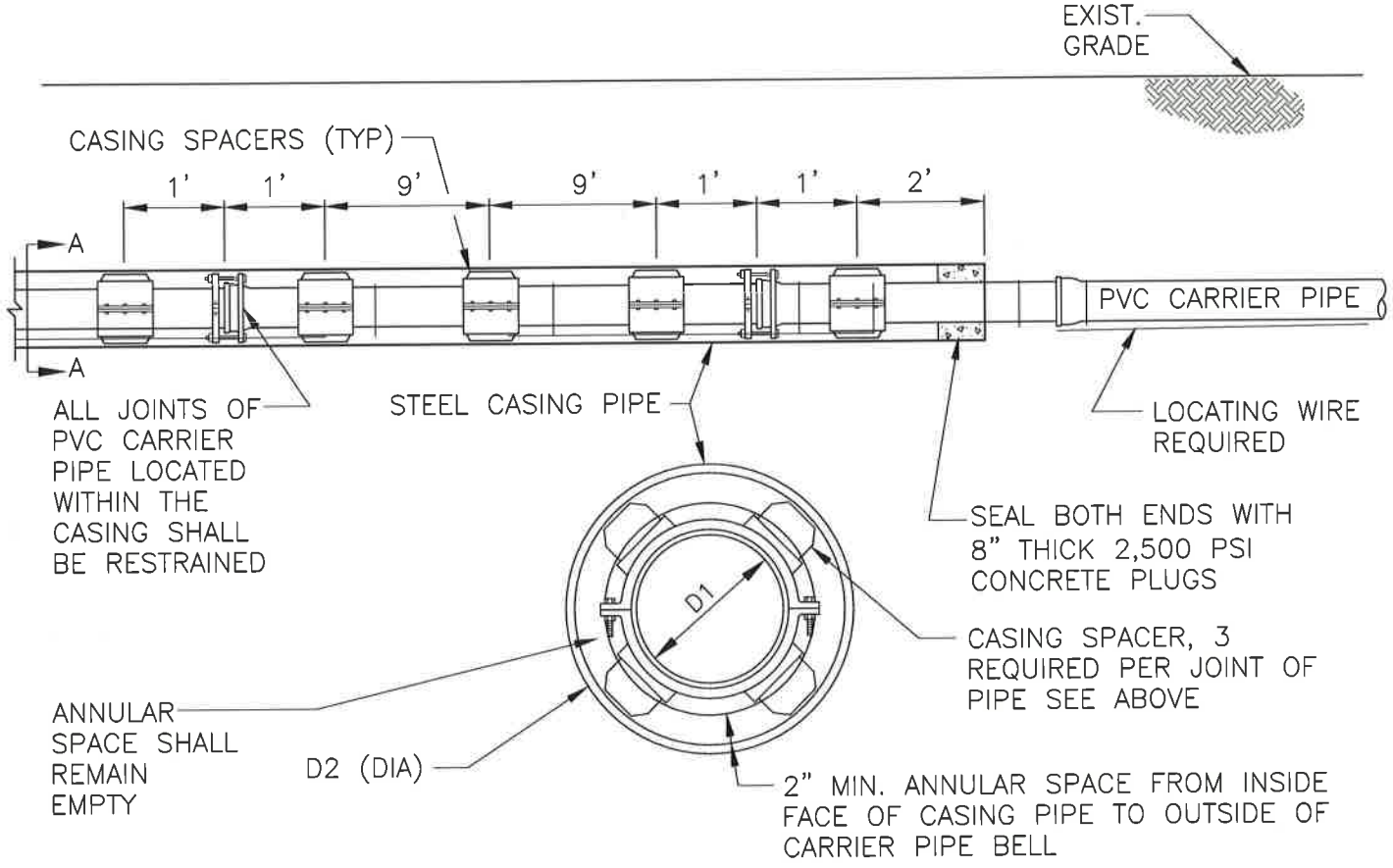


NOTES:

1. ALL PVC WATER MAIN SHALL REQUIRE INSULATED METALLIC LOCATING WIRE (12 GAUGE, SOLID STRAND COPPER W/TYPE UF INSULATION) CAPABLE OF DETECTION BY A CABLE LOCATOR
2. WIRE SHALL BE ATTACHED TO THE TOP OF PIPE WITH DUCT TAPE, A MINIMUM OF THREE TIMES PER JOINT OF PIPE. LOCATING WIRE SHALL TERMINATE AT THE TOP OF EACH VALVE BOX
3. PROVIDE WIRE LENGTH CAPABLE OF EXTENDING 12" ABOVE TOP OF VALVE BOX IN SUCH A MANNER SO AS NOT TO INTERFERE WITH VALVE OPERATION.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Detail
Nassau County, Florida

FIGURE
W-7
March 2022
Project No.
9610-23-1
(Standards)



SECTION "A–A"

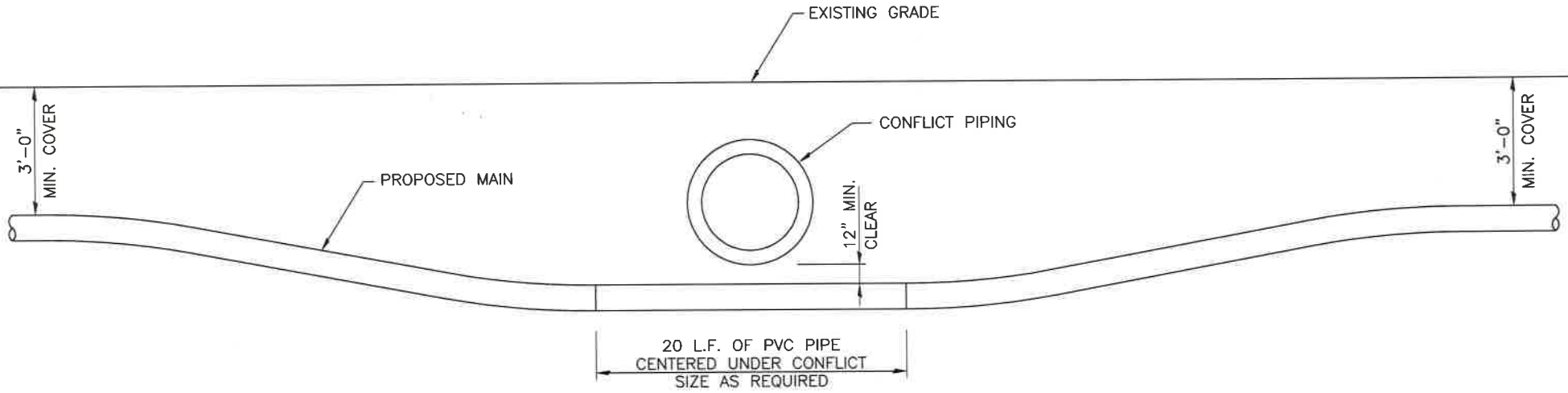
	CARRIER PIPE AND CASING PIPE SIZES (MIN.) IN INCHES											
CARRIER PIPE NOM. DIA. (D_1)	4	6	8	10	12	14	16	18	20	24	30	36
CASING PIPE NOM. DIA (D_2)	14	16	20	24	24	30	30	36	36	42	48	54
D.O.T. WALL THICKNESS	0.25	0.25	0.25	0.25	0.25	0.312	0.312	0.375	0.375	0.50	0.50	0.50

NOTES:

1. THE INSIDE DIAMETER OF THE CASING PIPE SHALL BE A MINIMUM OF 4–INCHES GREATER THAN THE OUTSIDE DIAMETER OF THE CARRIER PIPE BELL OR RESTRAINER COUPLING.
2. ALL PVC CARRIER PIPE JOINTS WITHIN CASING PIPE SHALL BE MECHANICAL RESTRAINED JOINTS.
3. FOR STREET USES WHICH ARE NOT D.O.T., USE D.O.T. CASING THICKNESS UNLESS OTHERWISE INDICATED BY ENGINEER.
4. CASING PIPE SHALL BE FURNISHED IN NOMINAL 8–FOOT LENGTHS (MIN.) UNLESS OTHERWISE INDICATED ON THE DRAWING.
5. CASING PIPE SHALL CONFORM TO EITHER ASTM STANDARD A139 FOR "ELECTRIC FUSION (ARC) WELDED STEEL PIPE". WITH A SPECIFIED MINIMUM YIELD STRENGTH (SMYS) OF 35,000 PSI OR "API SPECIFICATION API–5LX, GRADE X–42 WELDED STEEL PIPE".

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Roadway Jack & Bore Crossing Detail
Nassau County, Florida

FIGURE
W–8
March 2022
Project No.
9610–23–1
(Standards)



NOTES:

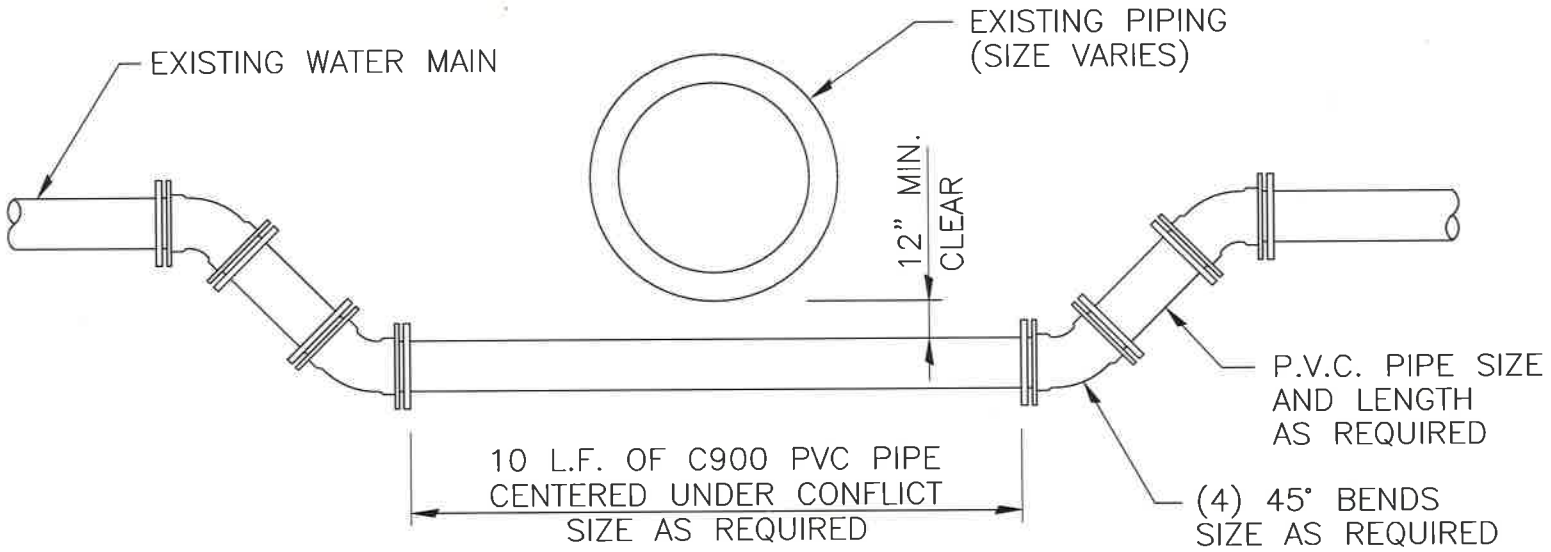
1. CONTRACTOR SHALL FULLY SUPPORT/BRACE ALL CONFLICT PIPING THROUGHOUT ENTIRE DURATION OF CONVENTIONAL INSTALLATION OF WATER MAIN UNDER CONFLICT MAIN.

2. CONTRACTOR SHALL BE REQUIRED TO FULLY REPAIR OR REPLACE ANY EXISTING PIPING DAMAGED DURING THE INSTALLATION PROCESS.

3. CONTRACTOR SHALL BE REQUIRED TO DIRECTIONAL DRILL UNDER ANY PIPING GREATER THAN 24" DIAMETER AND ANY CULVERTS WITH MORE THAN ONE CROSS DRAIN.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Utility Conflict Type A
Nassau County, Florida

FIGURE
W-9
March 2022
Project No.
9610-23-1
(Standards)



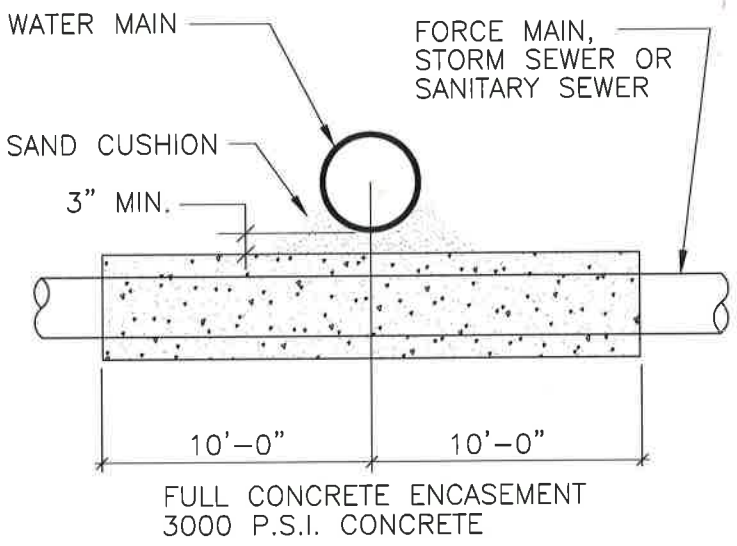
NOTES:

1. CONTRACTOR TO VERIFY EXISTING AND PROPOSED ELEVATIONS AT ALL UTILITY CONFLICT LOCATIONS.

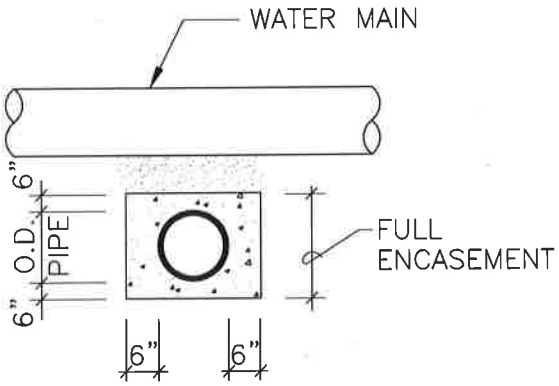
2. ALL JOINTS (PROPOSED AND EXISTING) AT UTILITY CONFLICTS SHALL BE MECHANICALLY RESTRAINED.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Utility Conflict Type B
Nassau County, Florida

FIGURE
W-10
March 2022
Project No.
9610-23-1
(Standards)

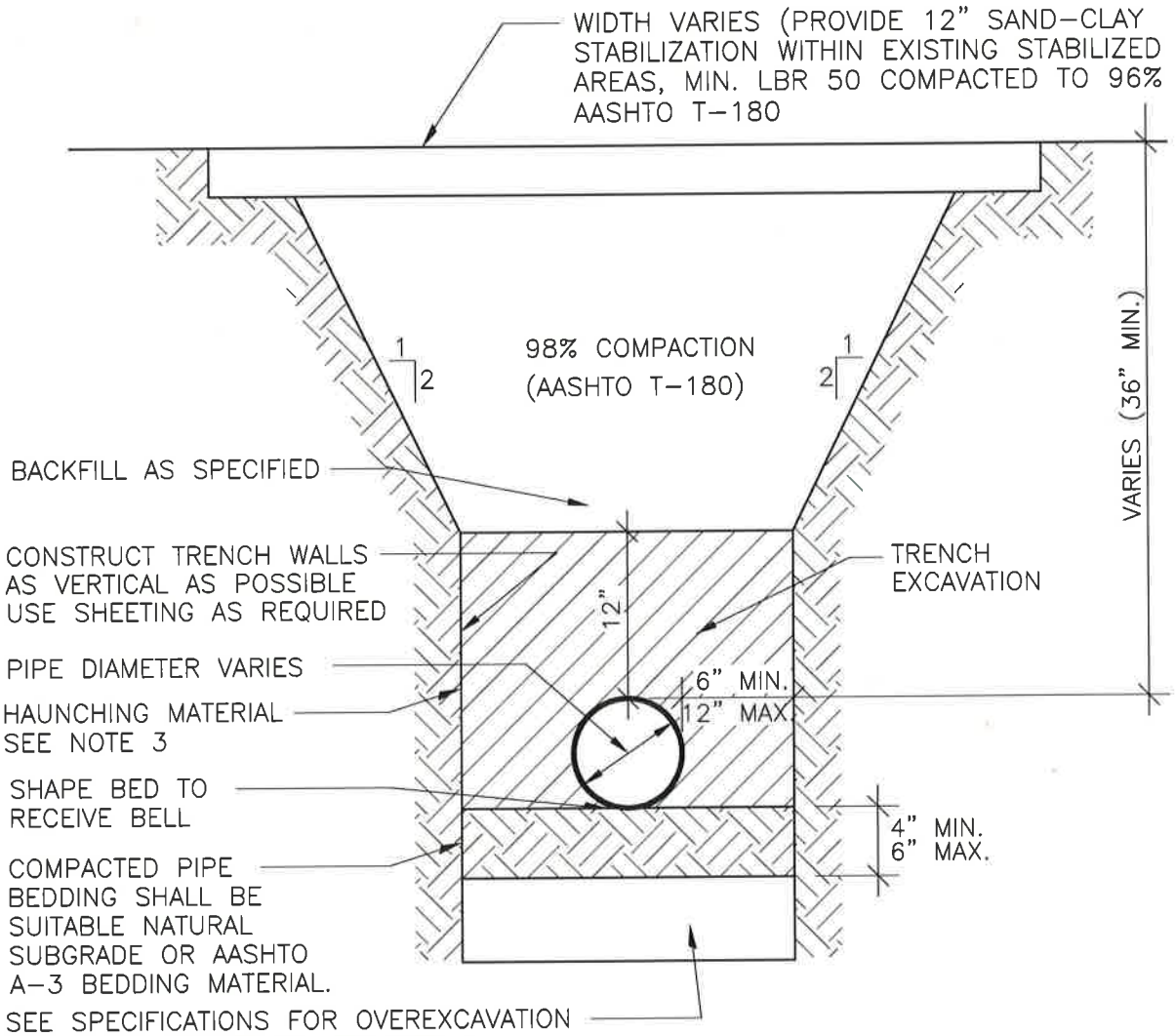


FULL CONCRETE ENCASEMENT
3000 P.S.I. CONCRETE



TOWN OF HILLIARD
Standard Specifications for Utility Construction
Typical Concrete Encasement
Nassau County, Florida

FIGURE
W-11
March 2022
Project No.
9610-23-1
(Standards)

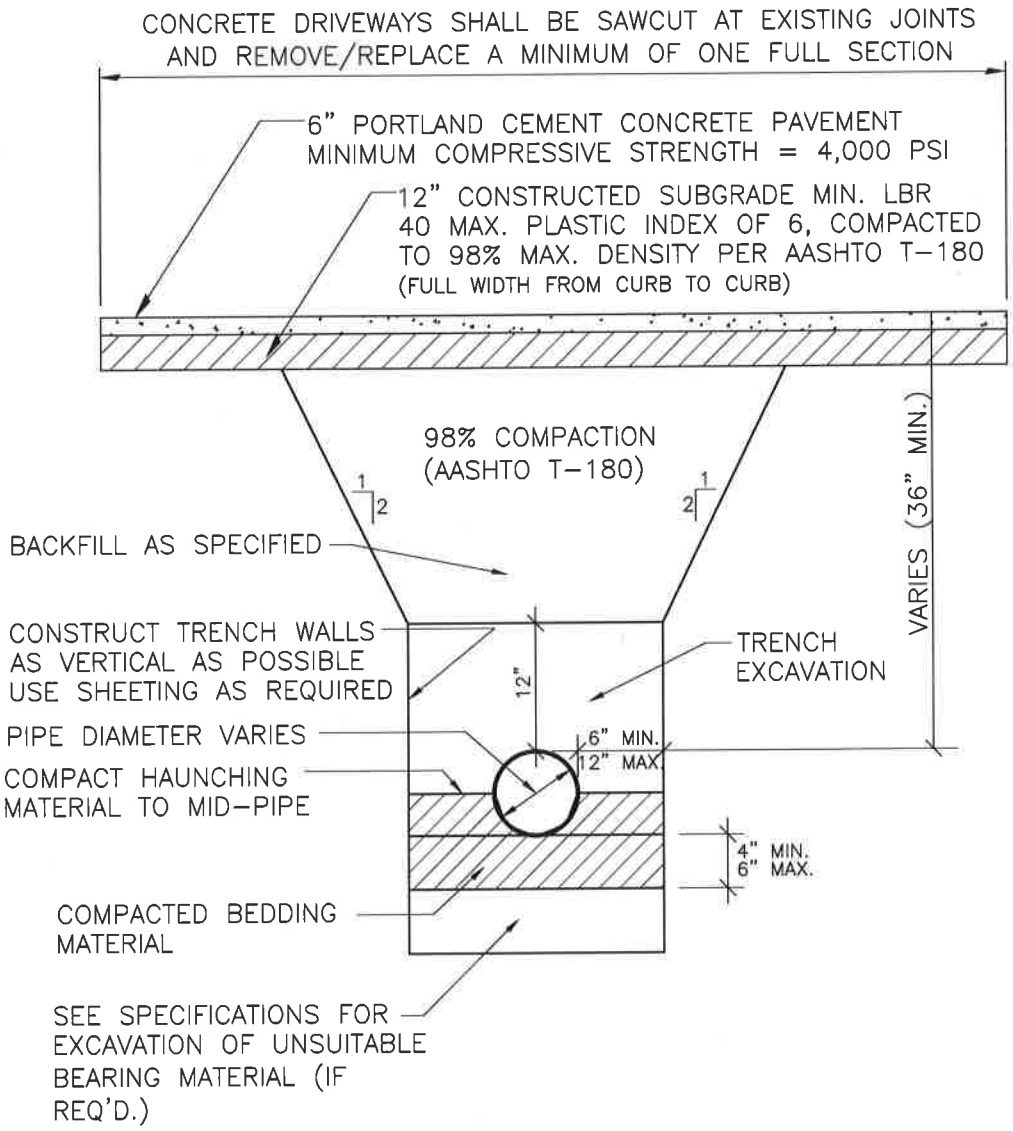


NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. PIPE INSTALLATION SHALL MEET THE REQUIREMENTS OF AWWA C-605 TYPE 4 LAYING CONDITION AND AS MODIFIED BY THIS DETAIL.
3. HAND COMPACT HAUNCHING MATERIAL IN 6" LIFTS COMPACTED TO 95% OF THE MAXIMUM DENSITY PER AASHTO T-180 TO 12 INCH ABOVE TOP OF PIPE.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail
Nassau County, Florida

FIGURE
W-12
March 2022
Project No.
9610-23-1
(Standards)

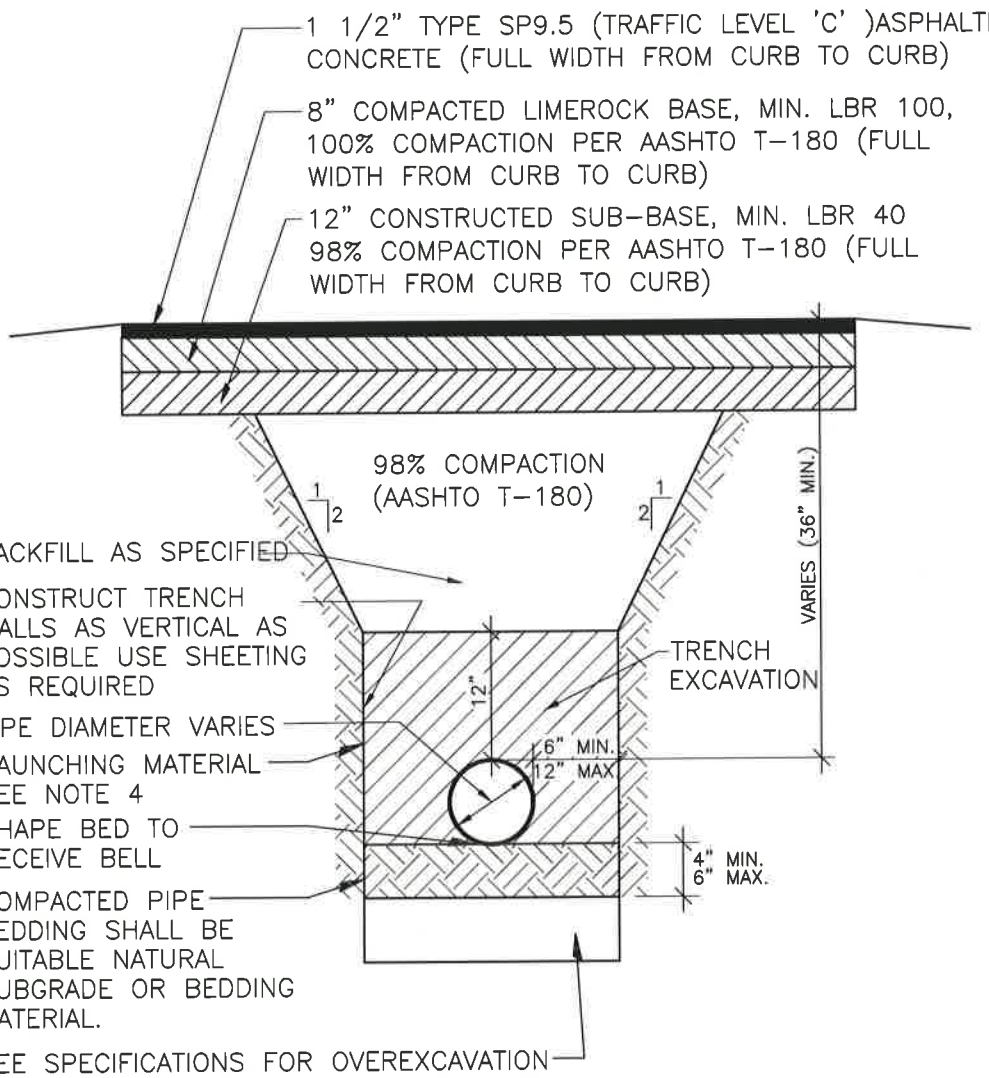


NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. MAXIMUM WIDTH OF REPLACEMENT SHALL BE 10 FT. OR TO NEAREST EXISTING JOINT, WHICHEVER IS LESS
3. PROVIDE SAW CUT CONTROL JOINTS AT 10' C-C EACH WAY

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail in Concrete Roadways
Nassau County, Florida

FIGURE
W-13
March 2022
Project No.
9610-23-1
(Standards)

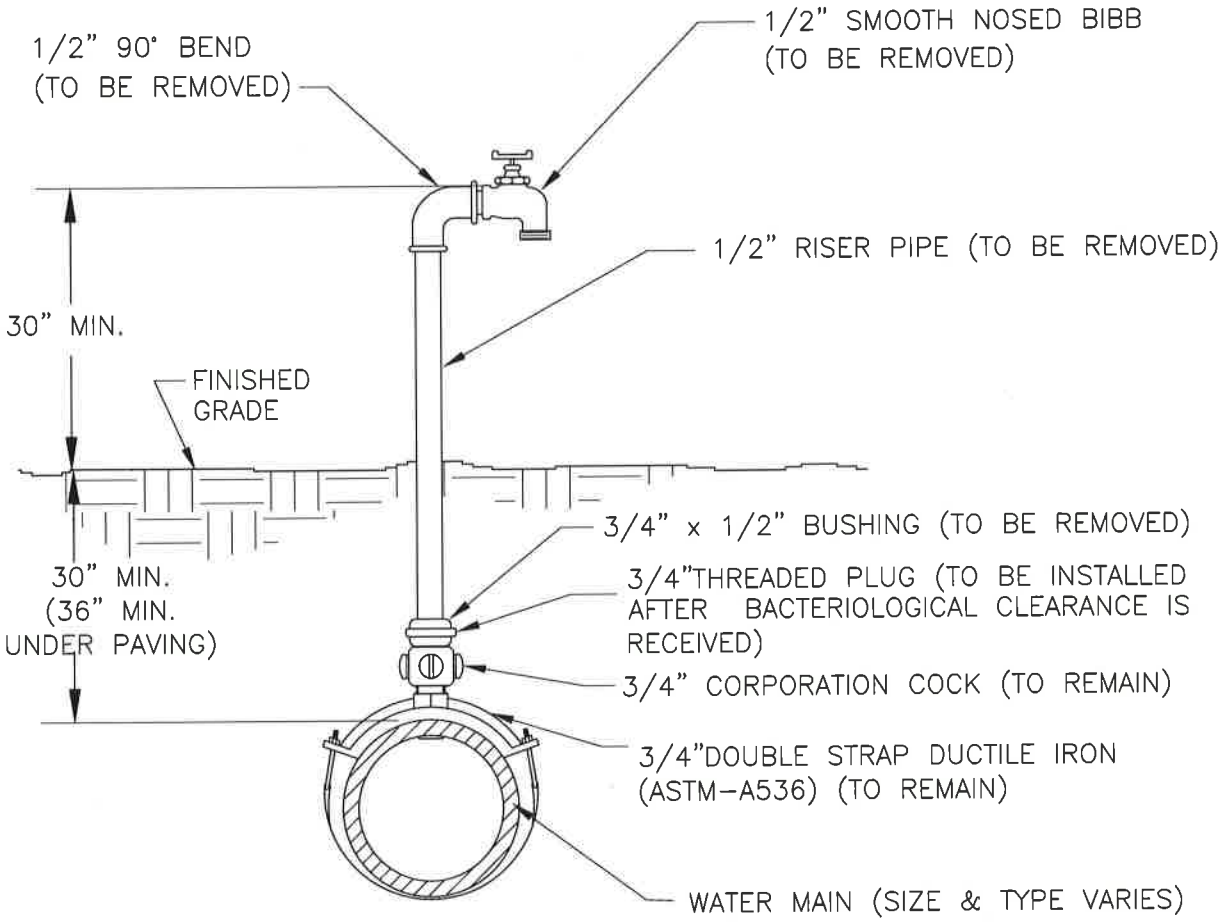


NOTES:

1. DEWATERING SHALL CONTINUE UNTIL BACKFILL IS COMPACTED AT LEAST 2 FEET ABOVE WATER TABLE.
2. SURFACE TREATED PAVEMENT JOINTS SHALL BE LAPPED AND FEATHERED.
3. PIPE INSTALLATION SHALL MEET THE REQUIREMENTS OF AWWA C-600 TYPE 2 LAYING CONDITION AND AS MODIFIED BY THIS DETAIL.
4. COMPACT HAUNCHING MATERIAL IN 6" LIFTS COMPACTED TO 98% OF THE MAXIMUM DENSITY PER AASHTO T-180 TO 12 INCH ABOVE TOP OF PIPE.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Trench Detail in Asphalt Roadways
Nassau County, Florida

FIGURE
W-14
March 2022
Project No.
9610-23-1
(Standards)



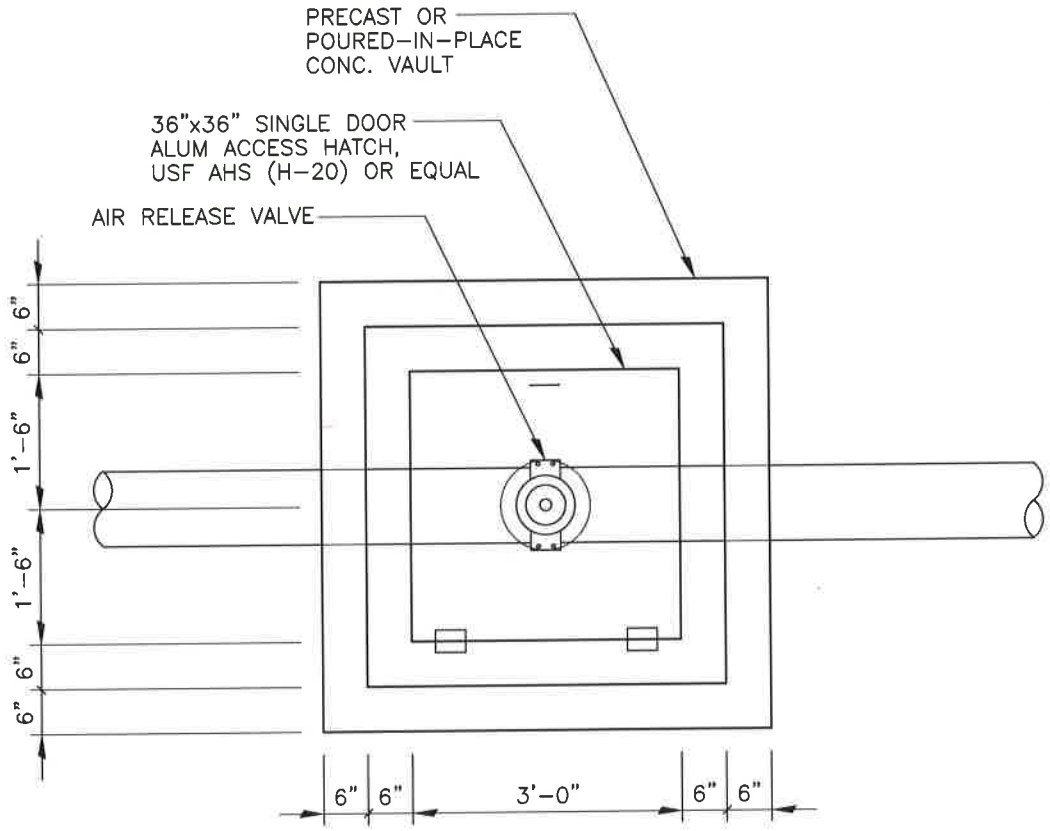
NOTE:

1) LOCATION OF SAMPLE POINT BIBB SHALL NOT BE WITHIN THE ROADWAY BUT ROUTED TO THE ROADWAY SHOULDERS (NON-TRAFFIC AREAS) OF THE ROAD (WHERE APPLICABLE)

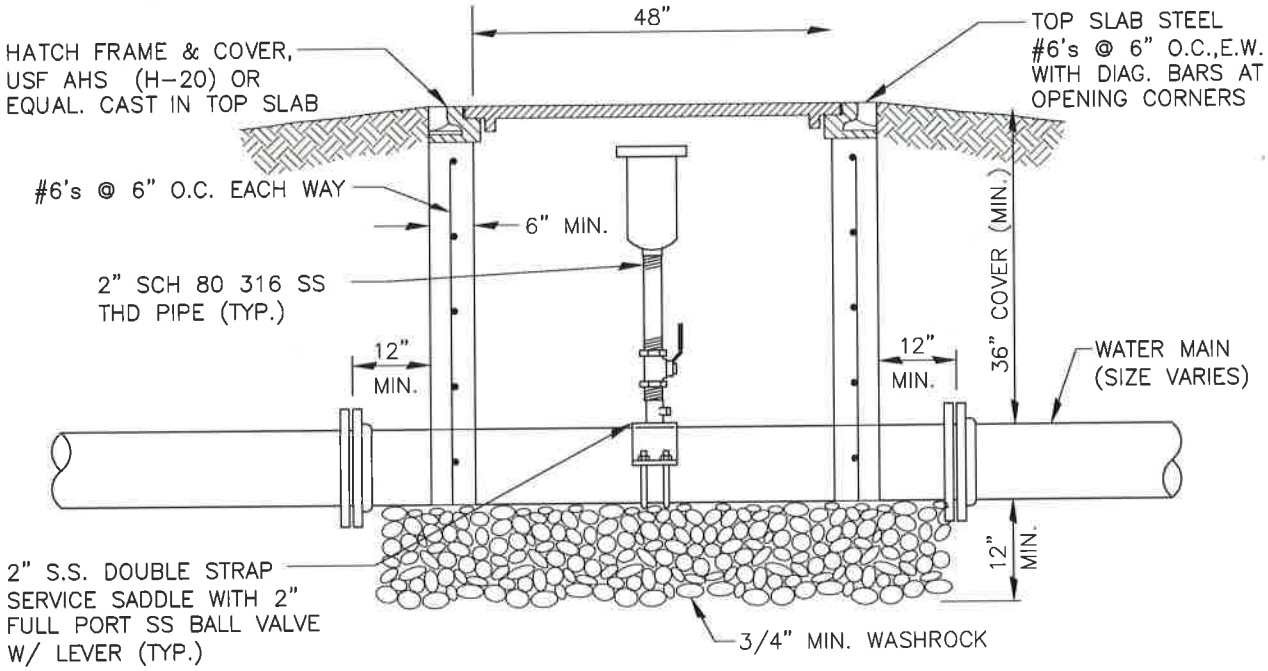
2) THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL PIPING & FITTINGS NOTED AFTER BACTERIOLOGICAL CLEARANCE FROM THE HEALTH DEPARTMENT.

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Temporary Sample Tap
Nassau County, Florida

FIGURE
W-15
March 2022
Project No.
9610-23-1
(Standards)



PLAN



SECTION

NOTES:

1. 4000 P.S.I., CONCRETE.
2. VAULT SHALL BE PRECAST OR POURED IN PLACE CONCRETE ALL WITH STEEL REINFORCING. BOX MAY HAVE SLOTTED BOTTOM (I.E. DOGHOUSE) TO ALLOW BOX TO BE SET OVER PIPE.

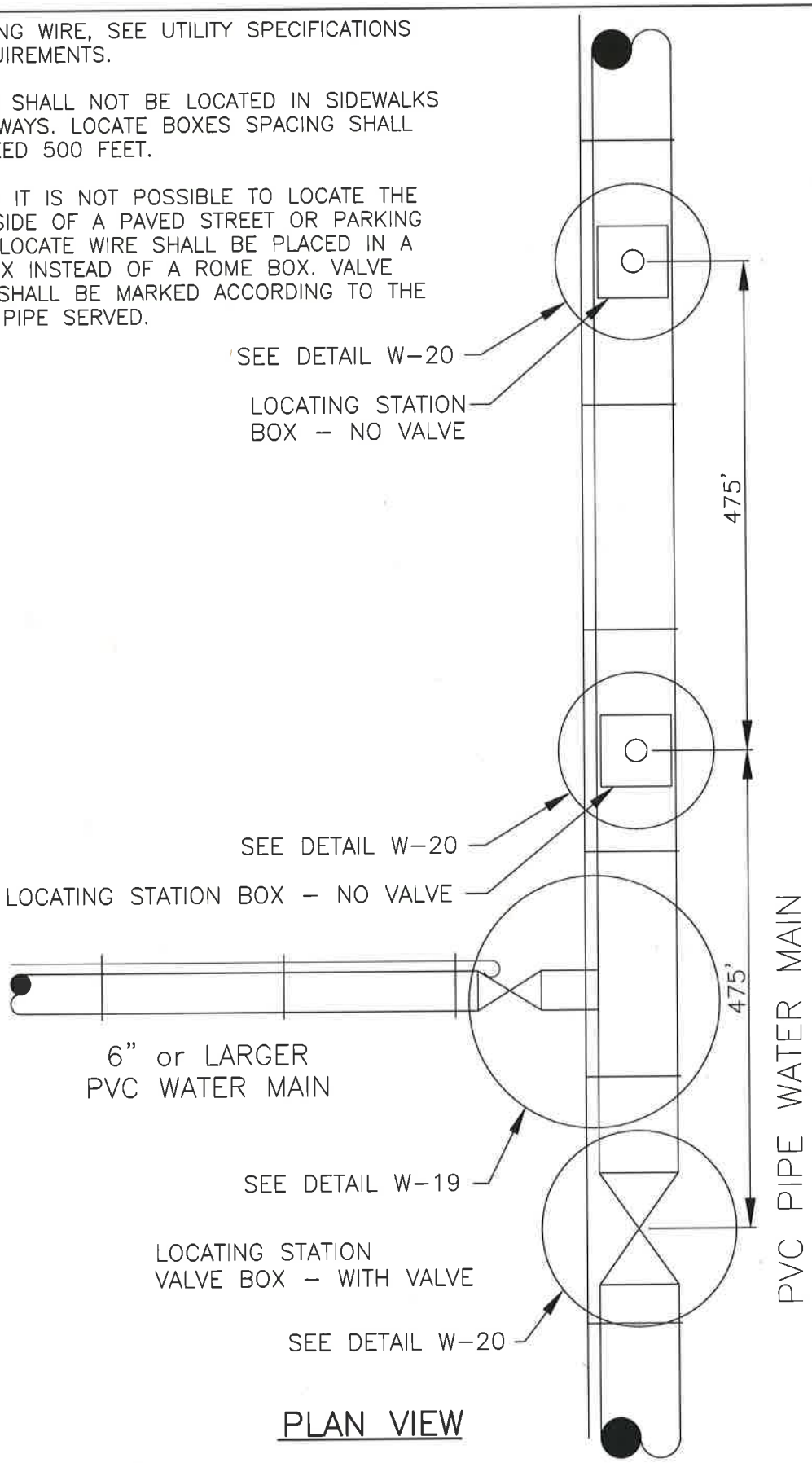
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Air Release Valve
Nassau County, Florida

FIGURE
W-16
March 2022
Project No.
9610-23-1
(Standards)

1. LOCATING WIRE, SEE UTILITY SPECIFICATIONS FOR REQUIREMENTS.

2. BOXES SHALL NOT BE LOCATED IN SIDEWALKS OR DRIVEWAYS. LOCATE BOXES SPACING SHALL NOT EXCEED 500 FEET.

3. WHERE IT IS NOT POSSIBLE TO LOCATE THE BOX OUTSIDE OF A PAVED STREET OR PARKING LOT THE LOCATE WIRE SHALL BE PLACED IN A VALVE BOX INSTEAD OF A ROME BOX. VALVE BOX LID SHALL BE MARKED ACCORDING TO THE TYPE OF PIPE SERVED.



PLAN VIEW

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
W-17
March 2022
Project No.
9610-23-1
(Standards)

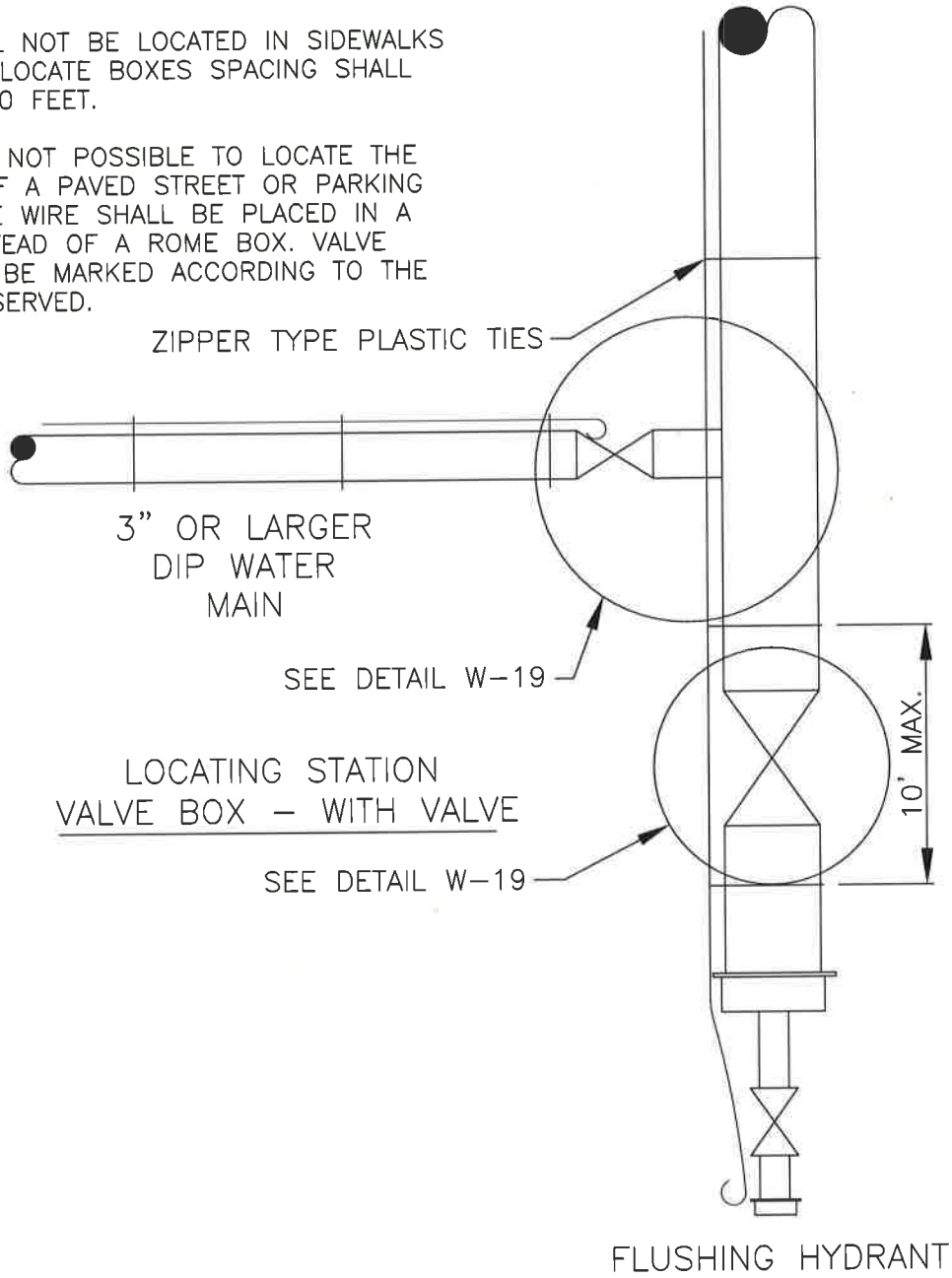
M:\CAD Files\Hilliard\9610231 Permitting, Compliance & Miscellaneous Small Projects\Standard Utility Details\Hilliard - Water System Construction Details.dwg, 3/16/2022 12:59:18 PM

NOTES:

1. LOCATING WIRE, SEE UTILITY SPECIFICATIONS FOR REQUIREMENTS.

2. BOXES SHALL NOT BE LOCATED IN SIDEWALKS OR DRIVEWAYS. LOCATE BOXES SPACING SHALL NOT EXCEED 500 FEET.

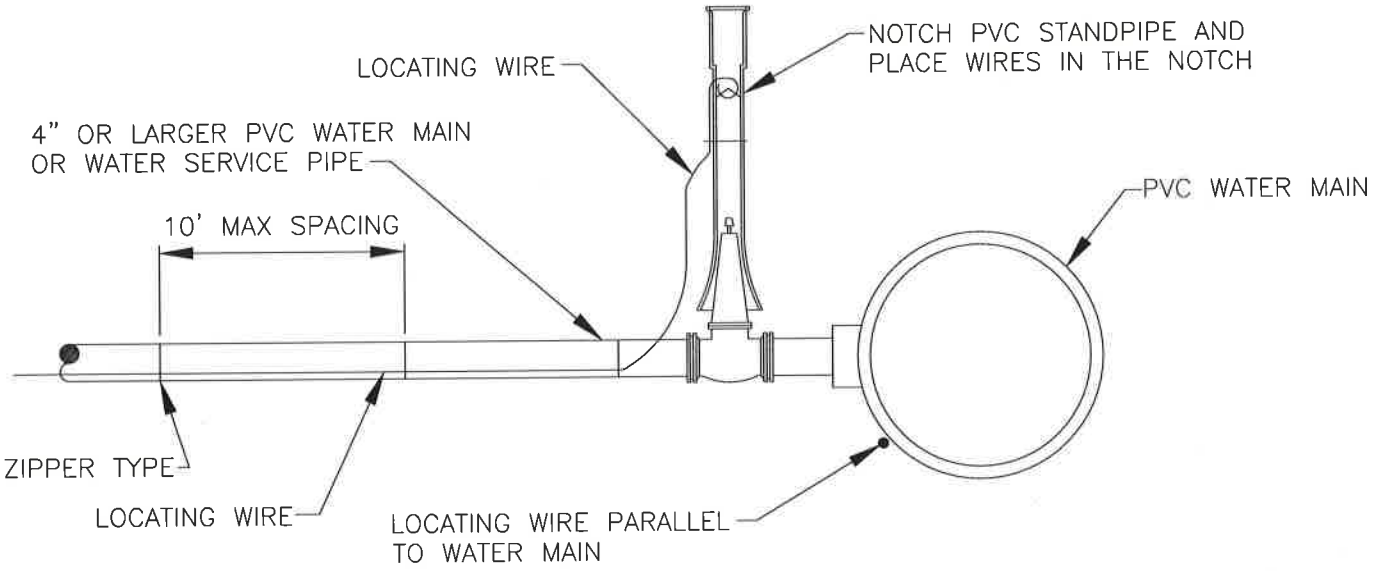
3. WHERE IT IS NOT POSSIBLE TO LOCATE THE BOX OUTSIDE OF A PAVED STREET OR PARKING LOT THE LOCATE WIRE SHALL BE PLACED IN A VALVE BOX INSTEAD OF A ROME BOX. VALVE BOX LID SHALL BE MARKED ACCORDING TO THE TYPE OF PIPE SERVED.



PLAN VIEW

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

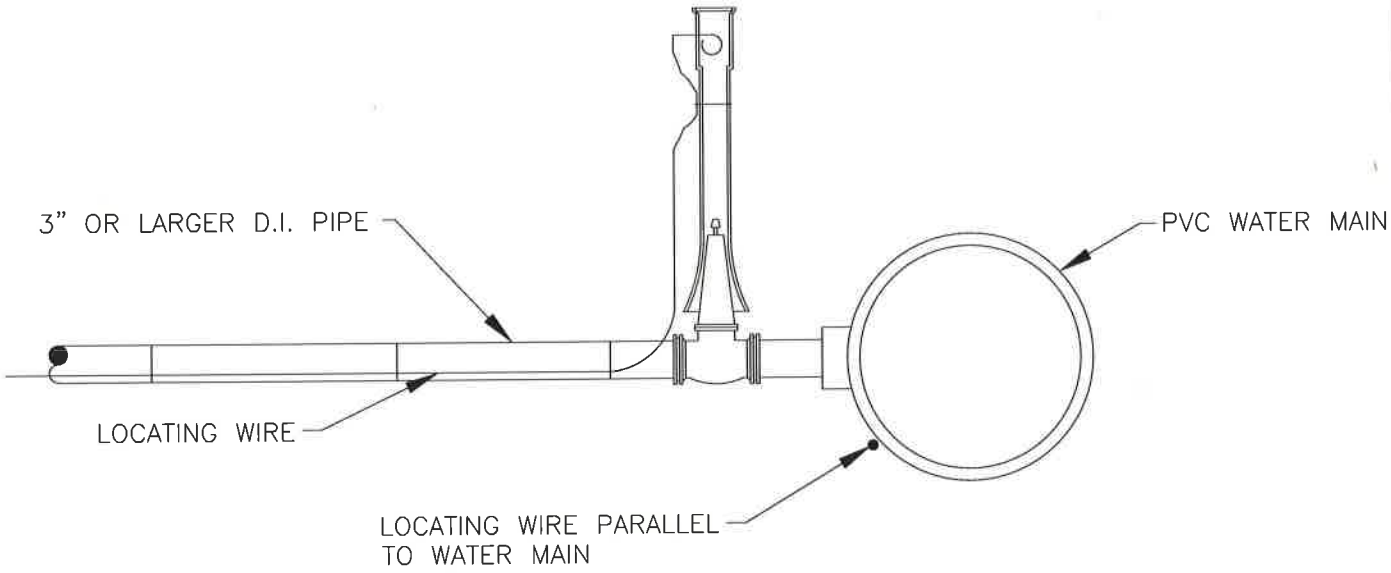
FIGURE
W-18
March 2022
Project No.
9610-23-1
(Standards)



CONNECTION TO PVC MAINS

4" OR LARGER PVC WATER MAIN

DETAIL – A



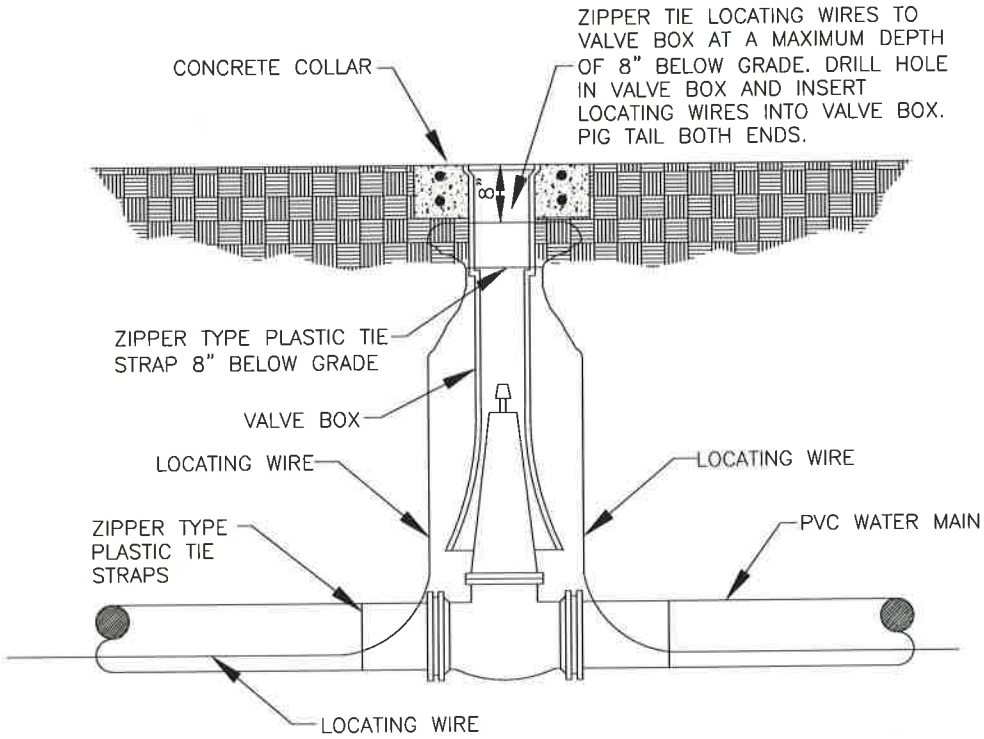
CONNECTION TO PVC MAINS

w/3" OR LARGER D.I. WATER MAIN

DETAIL – B

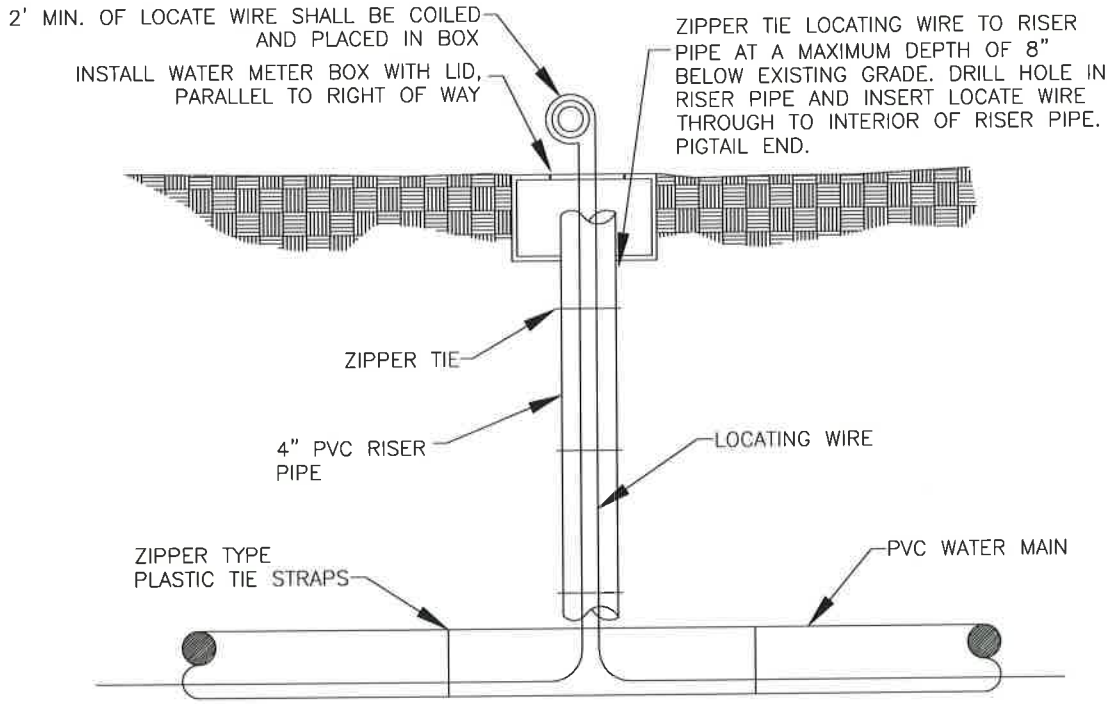
TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
W–19
March 2022
Project No.
9610–23–1
(Standards)



IN LINE LOCATING STATION– PVC PIPE

VALVE BOX WITH VALVE



IN LINE LOCATING STATION – PVC PIPE

METER BOX

TOWN OF HILLIARD
Standard Specifications for Utility Construction
Locate Wire Installation Details
Nassau County, Florida

FIGURE
W–20
March 2022
Project No.
9610–23–1
(Standards)