



STANDARD SPECIFICATIONS

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1. INTRODUCTION

- 1.1. The purpose of this document is to provide technical and procedural requirements for design and construction of line extensions (i.e. service connections, mains, and other water and/or wastewater facilities connecting to or extending Bonita Springs Utilities (BSU) facilities). This document provides requirements for Developers/Owners, Engineers of Record, and Contractors.
- 1.2. The intent of this document is to maintain consistency with all local, state, and federal regulations and does not preclude compliance with South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (FDEP), Florida Department of Health (FDOH), Florida Department of Transportation (FDOT), United States Army Corps of Engineers (USACE), City of Bonita Springs Development Standards, Village of Estero Development Standards, Lee County Development Standards, and any other Authority Having Jurisdiction (AHJ). Any deviations with the Standard Specifications and Standard Details or conflicts with local codes and ordinances should be noted prior to submittal of the plans.
- 1.3. Any reference made to specifications outside of this document is assumed to be to the current edition of such (e.g. ANSI, AWWA, etc.), unless otherwise specified.
- 1.4. Please be advised that the Engineer of Record is responsible for ensuring that the plans and specifications for projects are in full compliance with the BSU Standard Specifications and Standard Details.
 - 1.4.1. Plans reviewed and approved for construction by BSU, that are not in full compliance with these standards, shall be considered approved contingent upon those deficient items being brought into compliance prior to acceptance by BSU.

1.5. Deviation Request Procedure

- 1.5.1. Any deviation from the BSU Standard Specifications and Standard Details, not approved in writing by BSU prior to construction, shall require correction prior to acceptance of, and ultimately service to the project. This includes any items not directly addressed during the plan review and approval process that are not in compliance with the requirements of this document.
- 1.5.2. A deviation from the BSU Standard Specifications and Standard Details requires specific approval from the BSU Director of Engineering.
 - 1.5.2.1. A formal submittal is required for review by the BSU Engineering staff showing that the requested deviation will meet

or exceed the requirements of the specifications and is, at a minimum, equal to the specified product or methodology.

- 1.5.2.2. Attachments should be included for the requested product or methodology and/or a plan detailing the location for the deviation, if applicable.
- 1.5.2.3. All requests shall be submitted in writing by the Engineer of Record (signed and sealed), and shall not be approved for use in the BSU service area until approved in writing by BSU.
- 1.5.2.4. Plan revisions during construction due to unforeseen conflicts shall be submitted in writing to BSU prior to the change being constructed in the field.
 - 1.5.2.4.1. If the plan revision only requires BSU Engineering Staff approval and does not require approval of the Director of Engineering, the request can simply be made via e-mail and the approved changed can subsequently be reflected on the as-built record drawings.
- 1.5.2.5. Reviews for Deviation Requests are subject to the same review time as final plan submittal reviews. Accelerated reviews for deviation requests due to unforeseen circumstances will be handled on a case-by-case basis.
- 1.5.2.6. BSU inspectors cannot make decisions in the field, but can make recommendations that can be submitted by the Engineer of Record to the BSU Engineering staff for review.
- 1.5.2.7. Deviation Requests shall be submitted using the Deviation Request form.

2. SERVICE AVAILABILITY

- 2.1. Water and wastewater service are available in areas where infrastructure is currently in place or where a Developer agrees to install such infrastructure in accordance with a BSU approved master plan.
 - 2.1.1. Completed infrastructure shall be dedicated to BSU in accordance with procedures outlined in this document.
 - 2.1.2. Wastewater service is available for domestic quality sewage only, in accordance with the BSU Sewer Use Policy. Pretreatment of sewage may be required by BSU.

- 2.1.3. Storm water discharge and storm water systems shall not be allowed to connect to the sanitary sewer system under any circumstances, including discharge from dumpsters, trash compactors, swimming pool drains, fountain drains, and condensate drains; the discharge should instead be diverted into the storm sewer or other approved alternative.
- 2.1.4. The BSU wastewater system is a manifold system, and sanitary sewer service shall not be available to customers proposing to install and maintain localized privately owned pump stations, unless approved by BSU.
 - 2.1.4.1. The Developer, ON A TEMPORARY BASIS, MAY be allowed or required to connect to the wastewater system utilizing an Owner maintained pump station (normally a grinder station).
 - 2.1.4.1.1. If approved, the Owner shall be required to abandon the temporary pump station, connect to the central sanitary sewer system when available, and shall be responsible for their pro-rata share of the central sanitary sewer system.
 - 2.1.4.1.2. Temporary private pump stations shall normally be considered for less than 2 years
 - 2.1.4.1.3. Temporary septic systems in areas served by sanitary gravity sewer and/or sanitary sewer force mains shall not be allowed.

2.2. Capacity Availability Certification

- 2.2.1. Capacity availability certification requires the consent of the Company. Requests for certification may 2 to 3 weeks after receipt of written requests.
 - 2.2.1.1. Requests shall include (requests not including the required data shall be returned to the entity requesting capacity availability):
 - 2.2.1.1.1. Project Name
 - 2.2.1.1.2. Location Map with Address and Strap Number
 - 2.2.1.1.3. Engineer of Record
 - 2.2.1.1.4. Developer / Owner
 - 2.2.1.1.5. Estimated Water and Wastewater Flows Required
 - 2.2.1.1.6. Number of Residential Units or Square Footage of Commercial/Industrial Space that is the Basis for the Flow Estimate
 - 2.2.1.1.7. Projected Project Completion Date

3. PRE-APPLICATION

- 3.1. Engineers of Record and Developers are encouraged to set up a pre-application meeting for all construction projects, PRIOR to submitting an Application to Construct. Pre-application meetings will aide in eliminating costly redesign of projects based on BSU comments. Engineers of Record and Developers may also request for the City of Bonita Springs or Village of Estero to invite BSU to their pre-application meeting as to eliminate an extra meeting.
- 3.2. Requests for record drawing information of existing BSU infrastructure should be made prior to this meeting, including requests for manhole numbering or pump station number if a new pump station is to be proposed with the project.
 - 3.2.1. Manhole Numbers and Pump Station numbers are assigned by the BSU. Manhole numbers shall be per the BSU Manhole Numbering Plan Standard Detail.
 - 3.2.2. Utilize the Release of Data Authorization form for Record Drawing and GIS data requests.
- 3.3. Comments provided are subject to revision/modification by BSU staff during the review of the Application to Construct, at which time a more thorough review of the project will be performed.

4. MASTER PLANNING

- 4.1. Master planning of large projects is required to determine the impact of those projects on BSU infrastructure, and for BSU infrastructure planning.
 - 4.1.1. The master utility plan must be provided prior to a pre-application meeting, and must be included with the Application to Construct.
 - 4.1.2. Modifications, additions and/or deletions from the approved master plan may be required by BSU as BSU develops system wide master plans.
 - 4.1.3. Approval of a sanitary sewer and water master plan for a particular development does not preclude BSU from altering the sanitary sewer and water system layout as final construction plans are submitted for approval.

5. APPLICATION TO CONSTRUCT / CONSTRUCTION PLANS

- 5.1. Application for construction is to be done utilizing the appropriate Application to Construct form. Submittal information is included on the form. The plan review fee calculation is also included.

5.1.1. Submittals are to be sent to or dropped off at BSU.

5.1.1.1. Submittals shall be checked over by BSU staff to verify all forms have been completed in their entirety and that all of the required items are included as listed at the top of the Application to Construct.

5.1.1.1.1. A receipt of payment will be filled out by the staff for the submittal fee amount required to be paid. Fees will be collected by Customer Service. Engineering Staff cannot accept payments, but must verify the amount being paid.

5.1.1.1.2. An e-mail of the Application to Construct and Engineers Opinion of Probable Cost (OPC) to BSU Engineering staff prior to the submittal is encouraged for review of the payment, and can expedite submittal package review.

5.1.1.1.2.1. The OPC shall include all contingencies, engineering costs, mobilization costs, and all water and wastewater items to be reviewed.

5.1.2. If line extensions are required as part of the development, the current information relating to the water and/or wastewater plant operations necessary to complete the FDEP permit applications may be obtained from the Engineering Staff or BSU's website prior to the submittal. BSU will not fill in incomplete permit applications. BSU will also not sign a permit application that has not first been signed by the permittee. Incomplete/incorrect permit applications will be returned for completion/correction.

5.2. Plans shall be submitted in accordance with the BSU Standard Specifications and Standard Details. BSU Standard Detail sheets shall be included (unaltered) in each plan set. In general, plans will be reviewed within 2 weeks of the submittal. BSU agrees to complete reviews within 30 days of the submittal.

5.3. Landscaping plans are required to be submitted for review of potential conflicts with BSU infrastructure.

5.3.1. Landscaping plans are to show existing and proposed BSU infrastructure and easements.

5.3.2. Residential developments require individual lot planting plans to be submitted for each model type in the development.

5.4. Engineering Report

- 5.4.1. An Engineering Report shall be required for all submittals.
 - 5.4.1.1. This report shall be signed and sealed by a registered Florida Professional Engineer (P.E.).
 - 5.4.1.2. The report shall consist of relevant information detailing the intent of the submittal, including but not limited to the following:
 - 5.4.1.2.1. Project Name
 - 5.4.1.2.2. Engineer of Record
 - 5.4.1.2.3. Developer / Owner
 - 5.4.1.2.4. All Pertinent Contact Information for Both the Engineer of Record and Developer / Owner (Name, Address, Phone/Fax Numbers and E-mail Address)
 - 5.4.1.2.5. Brief Project Description
 - 5.4.1.2.6. Project Location Including Address and Strap Number if Applicable
 - 5.4.1.2.7. Number of Units or Square Footage of the Commercial/Industrial Space
 - 5.4.1.2.8. Type of Development (Single Family, Multi Family, Retail, Commercial, Industrial)
 - 5.4.1.2.9. Any Facility that Produces Grease Laden Waste (i.e. Fats, Oils, Grease) Must Include Calculations for Grease Retention (see BSU Fats, Oils, & Grease (F.O.G.) Specifications)
 - 5.4.1.2.10. Number of Stories for Buildings and Finished Floor Elevations
 - 5.4.1.2.11. Water and Wastewater Calculations Including Potable Water Meter Sizing (meter sizing calculations shall be provided utilizing AWWA M22, and shall be provided utilizing BSU's standard Water Meter Sizing form) and Backflow Preventer Sizing Calculations
 - 5.4.1.2.12. Shop drawings/cut sheets of proposed backflow prevention devices larger than 2"
 - 5.4.1.2.13. Pump Station Calculations and Pump Selection
 - 5.4.1.2.14. Latest Fire Flow Analysis
 - 5.4.1.2.15. Air Release Valve Calculations
 - 5.4.1.2.16. Anticipated Deviation Requests (Use the Deviation Request Form)
 - 5.4.1.2.17. Any Other Engineering Information Required for BSU to Review the Project

5.5. Construction Plans

- 5.5.1. Construction Plans shall not exceed a 1" = 40' scale.

- 5.5.2. The plans shall show the location, size, material, etc. of all existing and proposed infrastructure, including lines, valves, fire hydrants, air release valves (labeled with the manufacturer, model number and size), meters and backflows (greater than 2" shall be labeled with the manufacturer, model number and size), manholes, clean outs, pump stations and other appurtenances.
- 5.5.3. The plans shall contain the correct manhole number system as assigned by BSU.
- 5.5.4. Plans shall show the location of other existing and proposed utilities including gas, storm sewer, electric (including transformers and street lighting), irrigation lines, telephone, and any other utility or other obstruction (including landscaping) that may conflict with BSU infrastructure.
- 5.5.5. Plans shall show both plan and profile of all water and wastewater main lines including all conflicts.
- 5.5.6. Vertical deflections are to be shown in both the plan and profile views.
- 5.5.7. The attributes (e.g. material, diameter, etc.) of all sleeves/casings (including those for services) shall be labeled on the construction plans and as-built record drawings.
- 5.5.8. Proposed utilities shall be sized, designed and constructed to provide for future water and/or sanitary sewer service to all adjacent properties (i.e. service shall be extended to all adjacent parcels as directed by BSU). Approval of construction plans by BSU without utility connections to adjacent properties does not preclude the Owner or Developer from providing appropriate connections to adjacent properties during construction or prior to turnover and acceptance to BSU per these specifications.
- 5.5.9. All sheets are to be included as listed in the Sheet Index on the Cover Page.
- 5.5.10. The vertical control datum of orthometric height is to be The North American Vertical Datum of 1988 (NAVD 88).
- 5.5.11. The Contractor must keep a set of the Construction Plans stamped approved by BSU in the field at all times. Construction based off a non-approved plan set is subject to excavation and re-installation to the approved design, and will be at the Contractor's/Developer's expense.

5.6. Easements

- 5.6.1. Appropriate easements shall be required for utilities to be connected/looped to adjacent properties and it is the applicants' responsibility to acquire the easements prior to completion-dedication.
 - 5.6.1.1. BSU may assist the applicant as much as possible with the process.
 - 5.6.1.2. All proposed easements shall be shown on the plans, whether platted or not.
 - 5.6.1.3. Existing easements are to be shown on the plans, labeled with the instrument number as recorded with the Lee County Property Appraiser.
 - 5.6.1.4. For platted projects, the plat shall also be submitted with the construction plans for review and approval.
 - 5.6.1.4.1. Plats shall not exceed 1" = 60' scale. Modifications to the plat may be required and the construction plans may not be approved prior to those comments being implemented.
 - 5.6.1.5. The following language, unaltered, shall be required on each plat where utilities are to be dedicated to BSU:
 - 5.6.1.5.1. "Bonita Springs Utilities, Inc., and its successors and assigns, is hereby granted a perpetual, non-exclusive utility easement and right-of-way, upon, over, across, and below the surface of the public utility easements described and/or depicted on this plat for the purposes of construction, operation, maintenance improving or replacing of one or more water, sewer and/or utility transmission or distribution lines, and all normal appurtenances thereto."
 - 5.6.1.5.2. If the above language is not included on the plat, the plat shall not be accepted by BSU.
 - 5.6.1.6. A "Grant of Utility Easement" document and other appropriate documents shall be required for all utilities placed within easements, including easements shown on subdivisions that are platted.
 - 5.6.1.7. Easement sketches shall be at a scale not to exceed 1" = 40' and shall include the following (minimum):

- 5.6.1.7.1. Project Name (Coinciding with the Name Approved for Construction)
 - 5.6.1.7.2. Date
 - 5.6.1.7.3. Strap Number(s)
 - 5.6.1.7.4. Lot Number(s)
 - 5.6.1.7.5. Roads and Adjoining Roadways
 - 5.6.1.7.6. Easement Area Listed in ft² and Acres
 - 5.6.1.7.7. Easement Area Hatched (not Shaded)
 - 5.6.1.7.8. Other Easements (Drainage or Other Utility)
 - 5.6.1.7.9. Utility Infrastructure that is Constructed or Designed within the Easement
 - 5.6.1.7.10. Any Other Information Relevant to Allow an Expedious Review
- 5.6.1.8. Easements should allow for 7.5' on either side of all lines, 7.5' around any single piece of infrastructure (e.g. hydrants, manholes, etc.), and 30' x 30' for pump stations. Consult the Engineering Department for any special circumstances (e.g. master pump stations, wells, deep sanitary gravity sewer installations, extensions to property lines to avoid spite strips, etc.).
- 5.6.1.9. Easements shall not encroach upon building footers.
- 5.6.1.10. No trees or any other landscaping that is considered obstructive or has aggressive root systems shall be installed within the easement unless prior approval is obtained in writing from BSU.
- 5.6.1.11. Building overhangs are not permitted within BSU easements.
- 5.6.1.12. Easements must also be in compliance with the BSU Digital Geographic Information System and CAD Records Standards and Requirements item 4.3.10.
- 5.6.1.13. Deviations from the above requirements may be allowed, but must be coordinated with BSU prior to submittal.
- 5.6.1.14. BSU must review and approve all sketches and legal descriptions prior to recording. No sketch and legal description is to be recorded without a BSU approval for recording stamp on each page.
- 5.6.1.15. The applicant is permitted to record "Grant of Utility Easement" documents after review and approval, prior to turnover and acceptance for service.

- 5.6.1.15.1. If the applicant records the Grant of Utility Easement, the original must be submitted to BSU with the turnover package and/or prior to approval for service.
- 5.6.1.15.2. If the Grant of Utility Easement is changed and recorded without prior BSU approval, or if the sketch and legal description is not the approved version, BSU reserves the right to reject the easement and withhold service until an acceptable document with attachments is recorded.

5.7. Plan Approval

- 5.7.1. Plan approvals expire 1 year from the date of approval.
 - 5.7.1.1. Revised plans conforming to current BSU requirements shall be submitted on all projects where approval has expired. Any changes to BSU specifications since the expiration of the project approval shall be incorporated in the resubmittal.
 - 5.7.1.2. BSU reserves the right to review previously accepted, expired, resubmitted projects as if they are being submitted for the first time.
 - 5.7.1.3. Application fees also expire with plan expiration and require resubmittal based upon the current fee schedule.
 - 5.7.1.4. If underground water and/or wastewater utility construction for a project has not physically commenced prior to the 1 year approval anniversary, the project approval shall be considered as expired and a complete resubmittal, including fees, shall be required.
 - 5.7.1.5. Phased projects shall also be subject to the 1 year time frame, per phase. If a project is phased after the original submittal, additional submittals for those phases shall be required. If the infrastructure in a phased project is not to be completed and dedicated to BSU at the same time, additional submittals for those phases shall be required.
 - 5.7.1.5.1. If underground water and/or wastewater utility construction for the additional phases has not physically commenced prior to the 1 year approval anniversary, the project approval shall be considered as expired and a complete resubmittal, including fees, shall be required.
- 5.7.2. BSU approval does not obviate the need for obtaining applicable State, County, City, Village, or Health Department permits.

- 5.7.3. Any plan that was submitted that did not receive approval will expire after 1 year of no formal correspondence (e.g. response to Request for Additional Information). If the project is resurrected after expiration, a new submittal shall be required with all new applicable fees.

6. PRE-CONSTRUCTION

- 6.1. A pre-construction meeting is required for all projects, and no physical water or wastewater utility construction will be allowed to commence prior to.
 - 6.1.1. The start of physical construction shall be designated as actual effort by an underground utility contractor performing utility construction, based solely upon BSU discretion. Any break in physical construction greater than 1 year constitutes grounds for BSU to expire the construction plan approval permit.
 - 6.1.2. Upon issuance of the Construction Plan Approval and subsequent delivery of the Acknowledgment Letter to BSU, the pre-construction meeting is to be scheduled with BSU's Engineering Department.
 - 6.1.3. All pre-construction meetings are to be conducted at the Bonita Springs Utilities, Inc. office. On-site pre-construction meetings may be allowed for smaller projects (e.g. grease interceptors) with written permission from the BSU Engineering Department.
 - 6.1.4. A checklist of pre-construction topics and milestones that require notification and inspection can be located with the rest of BSU's forms.
 - 6.1.5. A BSU representative shall attend the pre-construction conference, and the Engineer of Record, Underground Utility Contractor, and an Owner's representative shall be present at all pre-construction meetings. The Engineer of Record, the Contractor, or the Owner's representative is responsible for coordinating the pre-construction meeting schedule with all parties. The General Contractor is welcome to attend, but it is not mandatory.
 - 6.1.6. The signed Acknowledgment Letter and revised construction plans (if the plans were approved with stipulations) shall be provided 1 week prior to the pre-construction meeting to allow BSU staff to review the plans to assure conformance to the stipulations of the approval.
 - 6.1.7. The pre-construction meeting shall be cancelled and required to be rescheduled if the plans have not been resubmitted for review, if the plans have not been revised to reflect all of the stipulations of the approval, if the Acknowledgment Letter has not been submitted or has

not been signed by the appropriate parties, and/or if all required parties are not present.

- 6.1.8. BSU requires six (6) signed and sealed approved plan sets for construction. Two (2) of the stamped approved plan sets will be returned to the Engineer of Record and/or Contractor. If additional plan set(s) stamped by BSU as approved are desired, additional plan sets will need to be provided.
- 6.1.9. Rescheduled pre-construction meetings may require additional fees to be paid prior to the meeting being rescheduled, based upon BSU Tariff rates.
- 6.2. In the event that project approvals were received more than 1 year prior to physical construction, new submittals and reviews are required as noted above. Changes made subsequent to BSU approvals shall be appropriately indicated, and re-approval of the changes is required prior to construction of those changes. Master planned developments are subject to the same review and approval as any other project.
- 6.3. The Contractor shall retain a copy of the BSU approval letter for the referenced project, a complete set of the BSU Standard Specifications (this document) under which the project was approved, and copies of approved Deviation Requests on-site during the course of construction. Non-compliance with this provision is terms for suspending work and inspection services for the project.
- 6.4. A licensed underground utility contractor shall be utilized for all utility work on existing or proposed BSU infrastructure. A qualified licensed general contractor with underground utility experience may be utilized with prior written approval from BSU.
 - 6.4.1. The underground utility contractor's company name must be revealed when scheduling the pre-construction meeting.
- 6.5. Additional fees, based upon BSU Tariff rates, shall be paid for any scheduled meetings or inspections with BSU personnel that are cancelled due to the absence of required parties not being present or the lack of required construction preparation. This fee shall be paid prior to scheduling any additional meetings or inspections with BSU personnel for that project. The following are examples of meetings and inspections that shall require additional fees to be paid: Pre-construction, Pre-acceptance Walkthrough Inspection, Final Inspection, any required utility testing, etc. It is the Applicant's / Owner's responsibility to cancel and reschedule any meeting or inspection requiring BSU personnel prior to the scheduled event/time in order to potentially avoid these fees. Five (5) business days' notice is required to schedule a pre-construction conference, and 48 hours' notice is required for all utility testing.

7. DESIGN, MATERIAL, AND TECHNICAL REQUIREMENTS

- 7.1. The Engineer of Record shall comply with the design and construction requirements as provided by the BSU Standard Specifications and Standard Details, and the design shall be in accordance with FDEP requirements.
- 7.2. Conflicts between the Specifications and the Standard Details shall be resolved in favor of the Specifications. Conflicts between the Specifications and Construction Plans shall also be resolved in favor of the Specifications.
- 7.3. Hydraulic calculations shall be submitted for plan approval. The Engineer of Record shall contact BSU for connection pressures for water and sanitary sewer pressurized mains at each location that the development will connect to the BSU system. The calculations and model of the development shall be submitted to BSU for insertion into the BSU master plans for review and inspection. The modeling software utilized shall be InfoWater by Innovyze.
- 7.4. Applicable BSU Standard Details must be included in the plan sets without alteration. These detail sheets are provided in 24"x36" .pdf format; BSU does not provide the details in AutoCAD format. If supplementary details are required they shall be included on additional sheets.
- 7.5. Vertical and horizontal separation requirements of water and sanitary sewer mains shall be in accordance with Florida Administrative Code Rule 62-555.314. (BSU Standard Detail CB-7)
- 7.6. Any development that diminishes, hampers, obstructs, restricts, or removes access to BSU infrastructure must be rectified to BSU Specifications accordingly to restore full access.
- 7.7. Anywhere pipes are to extend into or through structures, flexible, watertight joints shall be provided at the wall face.
- 7.8. Conflict boxes shall not be allowed without prior written approval from BSU.
- 7.9. All materials must meet or exceed appropriate AWWA and/or NSF standards.

7.10. Flow Demands

- 7.10.1. Flow demands for design shall be calculated on the basis of full development as known or projected.
- 7.10.2. The average daily flow for domestic use shall be calculated at the minimum rate of 100 gallons per day per capita (gpdpc) and an Equivalent Residential Connection (ERC) of 2.5 persons per single-family residence and 2.2 persons per multi-family and mobile home units.
- 7.10.3. The peaking factor used for design shall be 2.5 times the annual average day flow (AADF) value.
- 7.10.4. Flow demands for commercial, industrial, and special-type developments shall be established from existing records or by using the best available data. Approval from BSU shall be required for flow per unit from these types of projects. Florida Administrative Code Chapter 64E-6 "STANDARDS FOR ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS" is an example of best available data to be used to provide anticipated flows for these types of projects. This information can be accessed from <https://www.flrules.org/>.
- 7.10.5. Fire Flows shall be provided in accordance with Lee County, City of Bonita Springs, Village of Estero, and appropriate Fire Control District requirements. Prior to BSU approval, the Engineer of Record shall provide written approval from the appropriate Fire Control District. Coordination with the appropriate Fire Control District prior to submitting the Application to Construct is encouraged for each project.
- 7.10.6. Any private wastewater system connecting to BSU's sanitary sewer shall be tested and inspected to assure compliance with BSU standards. Under no circumstance shall substandard private systems generating excessive inflow and/or infiltration (I&I) be allowed to connect to the BSU wastewater system.

7.11. Water and Wastewater Infrastructure

7.11.1. Pressurized Mains

- 7.11.1.1. Water Distribution mains shall be sized to provide ample capacity for the required peak flow rates. Design computations shall be provided for system design.
- 7.11.1.2. Water main sizes shall also be in accordance with Lee County, City of Bonita Springs, and Village of Estero requirements.

- 7.11.1.2.1. The minimum allowable size for any water main shall be 4”.
- 7.11.1.2.2. The minimum allowable size for water mains with fire hydrants shall be 8”.
- 7.11.1.3. All water mains shall be looped. At a minimum, looping shall meet Land Development Code requirements; however, BSU shall determine the extent of looping and the looped main sizes. Water main looping is designed for water quality, redundancy, and for fire protection. Dead end mains are to be avoided whenever possible as to eliminate adverse effects on water quality.
- 7.11.1.4. Sanitary sewer force main systems shall be of adequate size to efficiently transmit the total ultimate peak operational flow to the effluent point.
 - 7.11.1.4.1. Consideration shall be given to possible future connecting pump stations, and this probability shall be reviewed with BSU.
 - 7.11.1.4.2. Capacity computations shall be coordinated with the proposed pumping system and future flow requirements, if applicable.
 - 7.11.1.4.3. In order to provide adequate pipeline cleansing, sanitary sewer force main flow velocity shall not be less than 2’ per second nor greater than 6’ per second at ultimate design minimum pumping capacity. However, with multiple pump station systems or phased development, this requirement may not be possible and the system design shall receive special attention regarding cleaning and maintenance.
- 7.11.1.5. In addition to initial capital expenditure, long term pump station operational costs shall also receive consideration when sizing sanitary sewer force main systems.
 - 7.11.1.5.1. Should a pipe size option be available within the design limits, the cost of sewage pumps and motors, sanitary sewer force main system and pump operating power (computed for design average daily flow rate for 10 years at existing electricity cost), shall be compared to like amounts for the alternate designs.
 - 7.11.1.5.2. The final sanitary sewer force main size selection shall be directed towards the system with the least long range

capital and operational cost. Said cost analysis shall be subject to review and approval by BSU.

- 7.11.1.6. Pressurized mains shall be designed to have 30" minimum cover from proposed finished grade except under vehicular travel ways, as determined by BSU. Under said vehicular travel ways, pressurized mains shall be designed to have a 36" minimum cover from proposed finished grade or per the requirements of the Authority Having Jurisdiction (AHJ) over the vehicular travel way. Maximum cover shall be 48" (i.e. top of the pipe to finished grade). Maximum allowable depth shall be 60" (i.e. bottom of the pipe to finished grade) with written BSU approval. The Engineer of Record should take line depth into consideration relating to the height and orientation of the valves to be provided for the proposed main line construction.
- 7.11.1.7. Special attention shall be given to sanitary gravity sewer lines or pump station wet wells that receive flow from sanitary sewer force mains. Care shall be taken in these areas to ensure excessive flow rates do not create surcharge conditions downstream. If the sanitary sewer force main velocity is greater than 2.5' per second at the termination, the sanitary sewer force main pipe size shall be increased 1 pipe size for the last 2 pipe joints, prior to the point of connection, to help dampen the velocity. Receiving manholes or pump stations shall be coated with a protective lining. Utilize BSU Standard Detail SS-3 for this connection.
- 7.11.1.8. Sanitary sewer force mains shall enter the terminal facility (sanitary gravity sewer manhole or pump station wet well) at a point equal to the operational water level of the receiving structure. Should an elevation drop be required to obtain the outlet connection, the prior downslope of the sanitary sewer force main shall not exceed 45 degrees and adequate air venting shall be provided at the profile breakpoint. The discharge end shall be designed so that the pipe remains full at all times, unless the sanitary sewer force main was upsized at the last 2 joints to dampen velocity. Sanitary sewer force mains discharging into pump station wet wells are to be dropped to 6" above the floor, utilizing the Internal Drop Manhole Connection as shown on BSU Standard Detail SS-3.
- 7.11.1.9. Pressure mains shall be PVC meeting the requirements of AWWA C900 DR18 class 235 rubber gasketed pipes with bell and spigot ends, or HDPE DR11 meeting the requirements of AWWA C906 with butt heat fusion joints.

- 7.11.1.10. Care should be exercised in the use of PVC and HDPE within the same pressure main due to differing inside diameters (e.g. a directional drill connecting 4" DR18 PVC on both ends shall be 6" HDPE DR11 in order to maintain an equivalent inside diameter).
- 7.11.1.11. Pressure mains located under vehicular travel ways, as determined by BSU, shall be AWWA C900 DR14 class 305, or HDPE DR11, and shall extend a minimum of 5' beyond the edge of the vehicular travel way, unless otherwise approved by BSU in writing.
 - 7.11.1.11.1. PVC DR18 CL235 C900 pipe may be accepted in low traffic areas only with prior written approval from BSU.
- 7.11.1.12. All pipe roadway crossings shall be constructed at 90 degree angles from roadways unless submitted in writing and approved by BSU as a Deviation Request.
- 7.11.1.13. Use of HDPE pipe must be approved by BSU in writing prior to construction.
- 7.11.1.14. PVC and HDPE pipe shall have ductile iron (D.I.P.S.) O.D. and shall be colored for water (blue or blue lined), sanitary sewer (green or green-lined), and reuse (purple or purple lined). Polywrap to designate the pipe color shall be used only with specific written approval from the BSU Engineering Department.
- 7.11.1.15. Directional drilling, if approved by BSU, shall require the use of HDPE DR11 pipe meeting AWWA C906 with butt heat fusion joints. If a casing pipe is required, the casing pipe shall be DR13.5 or DR11 HDPE pipe.
- 7.11.1.16. The use of ductile iron pipe is not permitted without prior written approval from BSU.
 - 7.11.1.16.1. If approved, the ductile iron pipe shall be identified with a colored sleeve (i.e. blue for water, green for sanitary sewer, or purple for reuse).
- 7.11.1.17. Polyvinyl chloride (PVC) pipe and High Density Polyethylene (HDPE) pipe may be damaged by prolonged exposure to direct sunlight and the Contractor shall take necessary precautions during storage and installation to avoid such damage. This also applies to all non-pressurized sanitary gravity sewer pipe.

7.11.1.17.1. The date of manufacture of all pipe to be utilized must be no older than 1 year when delivered to a BSU jobsite.

7.11.1.17.2. All pipe must be identifiable (i.e. markings must be visible to determine date of manufacture, DR rating, etc.).

7.11.1.18. Pipe Cleanliness

7.11.1.18.1. The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

7.11.1.19. Pipe Gradient

7.11.1.19.1. Lines shall be laid straight and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at the time of pipe installation.

7.11.1.20. Pipe Laying

7.11.1.20.1. Under no circumstances shall pipe or appurtenances be dropped or dumped into the trench.

7.11.1.20.2. All pipes shall have a uniform bearing on the trench bottom.

7.11.1.20.3. No trench water or dirt shall enter the pipe or joint spaces during pipe laying. A water tight plug shall be inserted in the open end of the piping when pipe lying is not in progress.

7.11.1.20.4. The pipe shall be cut as necessary to locate fittings and valves in the positions as shown on the approved Construction Drawings. The pipe shall be cut squarely and neatly, without damage to the pipe.

7.11.1.20.5. Plugs shall be set in openings that are left for branches to be installed later.

7.11.1.21. Pipe Joint Deflection

- 7.11.1.21.1. Pipe bending of PVC pipe shall not be allowed; fittings are required to be utilized to maintain horizontal and/or vertical alignment.
- 7.11.1.21.2. Pipe joint deflection, to allow pipe to be laid on the radius of a road, shall meet the manufacturer's specifications, and shall not be allowed without prior written approval from BSU.

7.11.2. Pressurized Main Jointing and Fittings

- 7.11.2.1. All pipes, water or sanitary sewer, shall be connected (i.e. belled together) per manufacturer's specifications.
- 7.11.2.2. All connections to water mains shall require a cut-in unless otherwise approved in writing by BSU. If hot taps are allowed, they shall be made with stainless steel MJ tapping sleeves and iron body gate valves. Size on size taps shall not be allowed. Taps shall be a minimum diameter of 2" smaller than the line size diameter being tapped.
- 7.11.2.3. Cut-ins shall be performed to connect to existing sanitary sewer force main facilities. No hot taps shall be allowed on sanitary sewer force mains without prior written approval from BSU. Hot taps may be requested on sanitary sewer force mains 16" and larger. Approved hot taps shall be made with stainless steel MJ tapping sleeves and iron body gate valves, and shall be a minimum diameter of 2" smaller than the line size diameter being tapped. The tapping valve shall be removed and replaced with a plug valve (or at the discretion of BSU, abandoned in the open position and subsequently have a plug valve installed adjacent to said tapping valve). Size on size taps shall not be allowed.
- 7.11.2.4. All fittings are to be shown on the as-built record drawings, labeled appropriately. Fittings (especially horizontal and vertical deflections) are also to be included in the submitted as-built CAD file at turnover so that their location can easily be input into BSU's GIS.
- 7.11.2.5. The particular joint used shall be approved by BSU prior to installation.
- 7.11.2.6. All polyvinyl chloride pipe shall be installed with PVC or ductile iron fittings.

- 7.11.2.7. If approved for use by BSU, all ductile iron pipe shall be installed with ductile iron fittings.
- 7.11.2.8. All AWWA C900 PVC fittings shall have a pressure rating of 150 psi and have hydrostatic design basis of 4000 psi, AWWA C907.
- 7.11.2.9. All ductile iron fittings shall be mechanical joint type with the minimum pressure rating of 250 psi and shall conform to the requirements of ANSI/AWWA Standard C110/A21.10 and/or C153/A21.53.
- 7.11.2.10. Fittings for HDPE pressure mains shall have electrofusion joints or butt heat fusion joints. All buried joints for HDPE pressure mains shall be butt heat fusion joints. All electrofusion joint fittings shall have ISO 9001 and NSF 61 certification. All butt heat fusion joint fittings shall conform to AWWA C906 and ASTM D 3261. All molded fittings shall be equivalent SDR rating as pipe being joined.
- 7.11.2.11. All HDPE fittings shall have a pressure rating equal to or greater than the adjacent pipe.
- 7.11.2.12. Electrofusion jointing shall be allowed only for those manufacturers approved by BSU.
 - 7.11.2.12.1. All electrofusion processors shall be equipped with bar code capability as well as manual operations.
 - 7.11.2.12.2. The processors shall be capable of printing out all fusion procedures made on the machine with complete information for total quality and installation control.
 - 7.11.2.12.3. Each day the machine operator shall supply BSU with a complete printout of the day's activity along with a construction log (including all temperatures and pressures utilized, where applicable) of all of the fusion (butt heat fusion or electrofusion) conducted on fittings or taps.
 - 7.11.2.12.4. Only individuals trained and certified by FS/AWWA on fusion procedures on HDPE shall be approved for installation of electrofusion fittings and taps.
- 7.11.2.13. In instances where horizontal or vertical spacing is confined, 90 degree fittings may be utilized with prior written approval by BSU; otherwise, two (2) 45 degree fittings shall be used in lieu of 90 degree fittings.

- 7.11.2.14. Spool pieces must be 3' minimum in length.
 - 7.11.2.14.1. In instances where horizontal or vertical spacing is confined, assemblies can be shortened by eliminating spool pieces and connecting 2 fittings together or connecting a fitting directly to a valve with the use of an approved MJ x MJ adapter.
 - 7.11.2.14.1.1. Use of MJ x MJ adapters must be called out on the construction plans and as-built record drawings.
- 7.11.2.15. All exposed piping shall be plain end or flanged ductile iron pipe and fittings with an operating pressure of 250 psi, and shall be manufactured in accordance with ANSI/AWWA C110/A21.10-1992.
- 7.11.2.16. All buried joints for PVC pressure mains shall be mechanical joint, push-on, or restrained type and shall conform to ANSI A21.11/AWWA C111.
- 7.11.2.17. Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI A21.11. Bolts shall be high strength annealed, weathering steel T-head type having hexagonal nuts. Bolts and nuts shall be machined through, and nuts shall be tapped at right angles to a smooth bearing surface. Single sealed gasket push-on type joints shall conform to the requirements of ANSI A21.11.
- 7.11.2.18. All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to BSU for review and approval before work is begun. Torque wrenches set as specified in AWWA Standard C111 shall be used; spanner type wrenches not longer than specified therein may be used with prior written approval from BSU.
- 7.11.2.19. Gaskets shall be elastomeric and conform to AWWA Standards and ASTM F-477. Gaskets shall have clean tips unless otherwise specified.
- 7.11.2.20. PVC pipe shall have provisions for expansion and contraction provided in the joints.

- 7.11.2.21. The joints of all PVC pipelines shall be made in conformity with the recommendations of the pipe manufacturer. No sulfur base compound joints shall be used.
- 7.11.2.22. All joints except threaded joints shall be designed for push-on makeup connections.
 - 7.11.2.22.1. The push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, or may be made with a separate twin gasketed coupling.
 - 7.11.2.22.2. Threaded joints shall be brass and shall be used only with Schedule 80 pipe or better.
 - 7.11.2.22.2.1. At threaded joints between PVC and metal pipes, the metal shall contain a socket end in the PVC side of the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.
 - 7.11.2.22.3. Push-on joints shall be made in strict, complete compliance with the manufacturer's recommendation. Lubricant, if required, shall be an inert, non-toxic, water soluble compound incapable of harboring, supporting, or culturing bacterial life. Manufacturer's recommendations shall be submitted to the Engineer of Record for review and approval before work is begun, and the manufacturer shall ensure that the Contractor has been advised of his recommended methods of installation.
- 7.11.2.23. All brass must be lead free per NSF 61 and made in the U.S.A.
- 7.11.2.24. While multiple manufacturers of pipe are permitted on a project, pipe from different manufacturers are not permitted to be connected directly to one another (i.e. the transition must take place at an MJ fitting).
- 7.11.2.25. Tapping Sleeves and Valves (BSU Standard Detail W-11)**
 - 7.11.2.25.1. Pressure main taps larger than 3", if approved in writing by BSU, shall be made with a tapping sleeve and valve.
 - 7.11.2.25.2. Tapping sleeves shall be 304 stainless steel with a 10 year warranty.

7.11.2.25.3. Valves shall meet the valve requirements for water main gate valves in these specifications.

7.11.2.25.4. All tapping sleeves shall be mechanical joint (MJ).

7.11.2.26. Restraints (BSU Standard Detail CB-1)

7.11.2.26.1. Where shown on plans or where, in the opinion of BSU, settlement or vibration is likely to occur, pressure main pipe joints shall be restrained. Approved restrainer glands will be permitted for restraint of ductile iron (DIP), and PVC pipe.

7.11.2.26.2. Restraints shall be placed a minimum of 2" from the end of the bell of the pipe.

7.11.2.26.3. Restraints on HDPE pipe joints and fittings are not required for butt heat fusion joints conforming to specifications.

7.11.2.26.4. Restraints shall be supplied with bolts consisting of high strength annealed, weathering steel T-head type having hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

7.11.2.26.5. Where specified, mechanical restrained type joints for pipe shall be factory type and fabricated at the factory. Field welding for joint fabrication is not acceptable.

7.11.2.26.6. A single manufacturer shall supply all components of the restraining method and accessories.

7.11.2.26.7. All valves shall be restrained as dead ends in both flow directions.

7.11.2.26.8. Prior to any connection, existing infrastructure is to be investigated for the existence and adequacy of restraints required for the new connection. Any required restraints are to be installed at the current Developer's cost.

7.11.2.27. Transition Couplings (BSU Standard Detail CB-5)

7.11.2.27.1. Connections between piping of the same nominal size but with non-matching outside diameters shall be made with transition couplings.

7.11.2.27.1.1. The coupling shall be fusion bonded epoxy coated ductile iron with bolts consisting of high strength annealed, weathering steel T-head type having hexagonal nuts and shall have EPDM (ethylene propylene diene monomer) gaskets. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

7.11.2.27.2. Connections/transitions between HDPE and PVC, 4" and larger, require written BSU approval and shall be constructed with an HDPE butt fused mechanical joint adapter with an MJ accessory kit, or other BSU approved connection. However, pump station sanitary sewer force main piping shall be constructed per the Standard Details.

7.11.2.27.2.1. Reducer fittings fused to the end of HDPE pipe are not permitted.

7.11.2.28. Coatings and Linings for Pipe and Fittings

7.11.2.28.1. All ductile iron pipe (mechanical joint, push-on, factory restrained and flange) shall be bituminous coated on the exterior, and ceramic epoxy lined (40 mils nominal dry film thickness) on the interior for pipe used for wastewater pressure and gravity mains.

7.11.2.28.2. All ductile iron pipe (mechanical joint, push-on, factory restrained and flange) shall be fusion bonded epoxy coated for water mains on the interior and exterior in accordance with ANSI/AWWA standard C-550 and C116/A21.16-15, or cemented lined with bituminous coating on the exterior for pipe used for water mains.

7.11.2.28.3. Ductile iron fittings for water mains shall be fusion bonded epoxy coated on the interior and exterior of fittings in accordance with ANSI/AWWA standard C-550 and C116/A21.16-15 and NSF 61 certification supplied by the manufacturer.

7.11.2.28.4. Ductile iron fittings for sanitary sewer force mains shall be ceramic epoxy lined (40 mils nominal dry film thickness) on the interior and bituminous coated on the exterior of fittings.

7.11.2.28.5. All fittings shall include the name of the manufacturer cast on the side in accordance with the above referenced ANSI/AWWA Standards.

7.11.2.28.6. The thickness of all linings shall be uniform.

7.11.3. Gate Valves (BSU Standard Detail W-9)

7.11.3.1. Valves shall be located at all intersecting mains (2 per tee and 3 per cross), including connections to existing mains, at the end of all lines to be extended, at all fire hydrants, on both sides of all water or wetland crossings, at both sides of all main line casings, jack and bores, directional drills, at a minimum of 1,000' along water mains, and at all other locations deemed necessary by BSU. BSU will dictate the layout and arrangement of gate valves to best suit the utilities' isolation needs.

7.11.3.2. Valves must not be installed more than 3' from the tee which is closest to the valve, unless a Deviation Request is approved by BSU in writing.

7.11.3.3. All buried valves shall have a 2" operating nut.

7.11.3.4. Gate valves 12" and smaller, unless approved by BSU in writing, shall be set with their stems vertically above the centerline of the pipe. All gate valves larger than 12" shall be horizontally mounted with a bevel gear operator.

7.11.3.4.1. The operating nut on all horizontally mounted valves shall be installed on the side of the main opposite the roadway for pipes installed adjacent to roads. The location of the operating nut shall be indicated on the construction plans and as-built record drawings, as well as included in the associated CAD file.

7.11.3.5. All valves shall have nuts and bolts consisting of Type 304 low carbon stainless steel at a minimum. The use of 316 stainless steel nuts and bolts may be required in areas of higher salinity, where corrosion has been previously noted, or as directed by BSU.

7.11.3.6. Valves for potable water shall be resilient wedge gate valves, and shall conform to AWWA Standard C509 or C515.

7.11.3.6.1. The exterior of the wedge shall be EPDM (ethylene propylene diene monomer). The wedge shall be

encapsulated with Delrin® guides for valves larger than 12”.

- 7.11.3.7. All valves shall be internally epoxy lined.
- 7.11.3.8. Valves shall be tested and certified by the manufacturer at 150 psi in both flow directions.
- 7.11.3.9. Valves shall be designed for not less than 150 psi WOG working pressure.
- 7.11.3.10. Valves shall be carefully inspected, opened wide and then tightly closed, and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat.
- 7.11.3.11. Any valve that does not operate correctly shall be removed and replaced.

7.11.4. Plug Valves

- 7.11.4.1. Valves shall be located at all intersecting mains (2 per tee and 3 per cross), including connections to existing mains, at the end of all lines to be extended, on both sides of all water or wetland crossings, at both sides of all main line casings, jack and bores, directional drills, at a minimum of 1,500’ along sanitary sewer force mains, and at all other locations deemed necessary by BSU. BSU will dictate the layout and arrangement of plug valves to best suit the utilities’ isolation needs.
- 7.11.4.2. Valves must not be installed more than 3’ from the tee which is closest to the valve, unless a Deviation Request is approved by BSU in writing.
- 7.11.4.3. Plug valves shall be installed on all subsidiary sanitary sewer force mains at the point of connection to the major main in order to isolate said pipeline for maintenance.
- 7.11.4.4. Where sanitary sewer force mains are to be extended, plug valves shall be placed at the future collection point to preclude line shutdown at the time of extension. At future connection branches or ends, the plug valves shall be restrained per the specifications in order to facilitate said connection without system shut down.

- 7.11.4.5. A 4" minimum plug valve shall be installed on a privately owned sanitary sewer force main adjacent to the connection to BSU's sanitary sewer force main (or edge of the easement if discharging into a manhole) and dedicated to BSU as this will become the point where BSU's ownership and maintenance responsibility shall terminate.
- 7.11.4.6. All buried valves shall have a 2" operating nut.
- 7.11.4.7. All valves shall have nuts and bolts consisting of Type 304 low carbon stainless steel at a minimum. The use of 316 stainless steel nuts and bolts may be required in areas of higher salinity, where corrosion has been previously noted, or as directed by BSU.
- 7.11.4.8. All valves shall be internally epoxy lined, 4 mils thick, and 3 mils thick exterior enamel.
- 7.11.4.9. Valves shall be carefully inspected, opened wide and then tightly closed, and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat.
- 7.11.4.10. Any valve that does not operate correctly shall be removed and replaced.
- 7.11.4.11. Eccentric plug valves 4"-36" shall meet or exceed the latest revision of AWWA Standard C517, and shall meet or exceed the requirements of this specification. The plug valves shall have the manufacturer's name cast in the body of the valve and shall be serialized for future parts identification.
- 7.11.4.12. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanges shall be per the ANSI B16.1 125 lb. standard. End-to-end length of flanged valves shall be per AWWA C517, Table 1. Mechanical joint ends shall be to the AWWA Standard C111-64.
- 7.11.4.13. Valve bodies shall be of ASTM A126 Class B cast iron. The port area shall be 100% of the standard pipe area (i.e. full port). The body shall have minimal pooling, and provide complete flushing of the valve every time it cycles. The port of the valve shall be rectangular.

- 7.11.4.13.1. All valves utilized on sanitary sewer force mains for in-line installation shall be of the plug type, full port (100% pipe area) style.
- 7.11.4.13.2. All valves utilized on pump station sites shall be of the plug type, full port (100% pipe area) style.
- 7.11.4.14. Valve seats shall be rectangular ported, 1/8" thick welded overlay of not less than 95% pure nickel. The seat area shall be at least 1/2" wide and raised, with the raised surface completely covered with weld to insure that the plug face contacts only nickel.
- 7.11.4.15. Plugs shall be solid, one-piece castings of ASTM A536 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The plug shall not contact the seat prior to being 90% closed. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. The plug shall be chloroprene (CR), or other resilient facing suitable for the application.
- 7.11.4.16. Bearings shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF8M. Non-metallic bearings shall not be acceptable.
- 7.11.4.17. Grit excluders in the form of PTFE washers at the upper and lower journals shall be provided to prevent the entry of grit and foreign solids into the bearing areas.
- 7.11.4.18. Shaft seals shall be of the multiple V-ring type with a packing gland follower. Shaft seals shall be externally adjustable and re-packable under pressure without removing the actuator or bonnet from the valve. An air gap shall exist between shaft packing and bottom of actuator for visual inspection, adjustment, or complete replacement of the packing without disturbing any portion of the valve or actuator except the packing gland follower. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.
- 7.11.4.19. The pressure ratings shall be 175 psi on sizes 4"-12" and 150 psi for 14"-36". Every valve shall be given a hydrostatic and seat test in both flow directions, with test results being certified when required by the specifications.

- 7.11.4.20. To prevent solids buildup around the lower bearing causing the valve to stick open, all plug valve installation arrangements shall be with the shaft horizontally mounted with a worm gear actuator. Plug valves 6" and larger shall be gear actuated.
 - 7.11.4.20.1. The side of the gear actuator shall be depicted on the construction plans and as-built record drawings, as well as included in the associated CAD file.
 - 7.11.4.20.2. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc., as specified. Non-buried actuators shall clearly indicate the valve position.
 - 7.11.4.20.3. Worm gears shall be constructed in accordance AWWA C517. Actuators shall be enclosed in a cast iron housing with outboard seals to protect the bearings and other internal components. The actuator shaft and quadrant shall be supported on permanently lubricated bronze bearings. The input shaft and fasteners shall be made of stainless steel.
- 7.11.4.21. Externally adjustable open and closed position stops shall be provided. The adjustable closed position stop shall be used to set the closing torque and provide adjustment to compensate for change in pressure differential or flow direction.
- 7.11.4.22. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuators shall be 90% grease filled. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals.

7.11.5. Check Valves

- 7.11.5.1. Check valves shall be horizontal, metal seat, swing type for sewage.
- 7.11.5.2. Check valves shall not be tilting disc or split disc types for raw sewage.
- 7.11.5.3. Surge analysis may be required, at the discretion of BSU, to determine quick close accessories (e.g. spring/level and weight). Surge analysis may also be required, at the discretion of BSU, for long and/or high head sanitary sewer force mains.

7.11.6. Valve Boxes

- 7.11.6.1. For 2" and larger valves, valve boxes shall be approved standard "Buffalo Type", cast iron, screw type adjustable shaft valve boxes having a minimum shaft diameter of 5¼".
- 7.11.6.2. The castings shall be coated with 2 coats of coal tar pitch varnish.
- 7.11.6.3. The lids of all boxes shall bear the word "WATER" or the letter "W" for valves in the potable water system, the word "FIRE" for valves for fire hydrants and fire protection systems, the word "SEWER" for valves in wastewater system, and the word "REUSE" for valves in the reclaimed water system.
- 7.11.6.4. Lids for potable water shall be painted blue, for fire systems shall be painted red, for raw water shall be painted white, for sanitary sewer systems shall be painted green, and for reuse systems shall be painted purple.
- 7.11.6.5. Shaft extension sections shall be cast iron only.
- 7.11.6.6. Valve boxes are not to be installed in the curb, unless approved in writing by BSU.
- 7.11.6.7. All valve boxes shall be made in the USA.
- 7.11.6.8. Valves for buried service, greater than 48" in depth, shall be equipped with an extended actuator mounting. The extension stem shall consist of a 2" operation nut and 316 stainless steel bolt or 316 stainless steel pin with stem guides (per the valve box and valve manufacturer instructions), such that the valve key is at a convenient height from grade for ease of operation.
- 7.11.6.9. A cast iron stopcock holder and a brick laid flat or other similar foot piece under each curb box shall be provided.
- 7.11.6.10. Valve boxes shall be set plumb and carefully centered over the operating nuts of the valves so as to permit a gate wrench to be fitted easily to the operating nut.
- 7.11.6.11. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset.
- 7.11.6.12. The trench backfill shall be tamped thoroughly for a distance of 3' on each side of the boxes.

- 7.11.6.13. Valve boxes shall conform to the level of the finished surface, held in position by a ring of concrete placed under the support flange as shown in the Standard Details. The valve box shall not transmit surface loads to the pipe or valve. Before final acceptance of the work, all valve boxes shall be adjusted to finished grade.
- 7.11.6.14. Care shall be taken to prevent earth and other material from entering the valve box.

7.11.6.15. Debris Caps

- 7.11.6.15.1. Debris caps are not required unless otherwise directed by BSU.
- 7.11.6.15.2. The debris cap shall be comprised of a hollow member having a cylindrical outer surface, a closure for 1 end, and 3 point resilient contact pads projecting from the outer surface. One (1) contact pad shall be movable by means of a cam having a low angle of advance whereby external forces applied to the cam via the movable contact pad do not cause rotation of said cam.
- 7.11.6.15.3. The cap shall have a flexible skirt providing an outward seal preventing debris from getting past the cap.
- 7.11.6.15.4. The cap must withstand, without slippage, a minimum vertical force of 50 lbs. at a loading rate of 1.0" per minute.
- 7.11.6.15.5. The cap shall be molded using General Electric ABS #HIM 4500 or equal.
- 7.11.6.15.6. The cap shall have retaining prongs to retain a standard locating coil.
- 7.11.6.15.7. Debris caps shall be installed as close under the cast iron cover without interfering with the cover operation.
- 7.11.6.15.8. Caps shall be blue for water, green for wastewater, red for hydrants and fire lines, and purple for reclaimed water.

7.11.7. Valve Pads (BSU Standard Detail CB-11)

- 7.11.7.1. Concrete valve pads with rebar shall be installed for all valves per the Standard Details, except those that reside in paved areas.

Valves that reside in areas with brick pavers can have the brick pavers cut around the valve box for a cleaner installation. Valves in concrete driveways or sidewalks can have the concrete poured seamlessly around the valve box, eliminating the pad.

- 7.11.7.2. Brass identification tags for valves are not required in paved areas, or in an area where a potential trip hazard exists; however, at BSU's discretion the tag may be required to be epoxy secured to the underside of the valve box lid.

7.11.8. Air Release and Vacuum Valves (BSU Standard Detail CB-4)

- 7.11.8.1. Where the profile of pressurized mains (water mains larger than 8") is such that air pockets or air entrapment could occur, provisions for air release shall be provided. Automatic air release assemblies shall be installed at vertical deflections on all pressurized mains (water mains larger than 8"), where the deflection is 4 times the diameter of pipe or greater, at a minimum spacing along the pressurized main of 1,500', or at locations designated by BSU.
- 7.11.8.2. At all profile break points on pressurized mains (water mains larger than 8"), such as localized high points, and where free flow will occur during operation or after pumping stops for sanitary sewer force mains, combined air release and vacuum valve assemblies shall be provided.
- 7.11.8.3. Air release and vacuum valves and/or air release valves shall be suitably housed in pedestal mounts. All air release valves are to be installed in an above-ground, vented enclosure. Air release valve installations in manholes are not permitted.
 - 7.11.8.3.1. The enclosure shall be blue for water, green for wastewater, white for raw water, and purple for reclaimed or reuse water, with "BSU 239-992-0711" imprinted on the top of the enclosure. The enclosures are not to be painted to meet the color requirements.
 - 7.11.8.3.2. For ARV's that are of a size larger than can be installed in an approved BSU standard enclosure, BSU shall require the enclosure be designed and detailed in the plan set prior to approval for construction, including consideration relating to the ARV supports for larger and/or double systems.
- 7.11.8.4. The Engineer of Record shall provide computations to support the location and size of air release valves with each submittal, including

consideration relating to the ARV supports and housings for larger and/or double systems.

- 7.11.8.5. Polytubing shall be used for connection of the ARV to the potable water main, and shall be 2" minimum.
- 7.11.8.6. Main line wastewater and raw water main ARV's shall be isolated with stainless steel nipples and a 2" stainless steel ball valve above the stone (larger sizes shall be approved in writing by BSU). Use of brass will not be permitted.

7.11.9. Blow Off Assemblies (BSU Standard Details W-5 and W-6)

- 7.11.9.1. Dead end lines shall not be allowed, unless there is no other alternative. Specific written approval from BSU is required for all dead end lines.
 - 7.11.9.1.1. If allowed, an automatic flushing device may be required as directed by BSU.
 - 7.11.9.1.2. Permanent blow off assemblies shall be required at the end of all permanent dead end lines and lines that are planned to be extended in the future, unless otherwise directed by BSU in writing.
 - 7.11.9.1.3. Temporary blow off assemblies shall only be provided with prior written approval from BSU. If at the time of the 11th month warranty inspection the temporary blow off assembly still exists (i.e. the line has not been extended), it shall be changed to a permanent blow off assembly at the expense of the warrantor.
 - 7.11.9.1.4. Flushing hydrants may only be utilized with written approval by BSU.

7.11.10. Fire Hydrants (BSU Standard Details W-2, W-3, and W-4)

- 7.11.10.1. Fire hydrants shall be spaced per the appropriate Fire Control District requirements.
- 7.11.10.2. All fire hydrants shall comply with AWWA C502.
- 7.11.10.3. Fire hydrants shall be of the compression type, closing with the line pressure.

- 7.11.10.4. The main gasket shall consist of EPDM (ethylene propylene diene monomer) encapsulated rubber.
- 7.11.10.5. Fire hydrants shall be furnished with a sealed oil reservoir located in the bonnet, so that all threaded and bearing surfaces are automatically lubricated.
- 7.11.10.6. Fire hydrants shall have internal cast flanges.
- 7.11.10.7. The lower stem shall be located below the top of the lower barrel.
- 7.11.10.8. The seat ring shall be bronze and thread into a bronze bushing located between the lower barrel and the shoe.
- 7.11.10.9. The lower barrel shall be designed so that the barrel can be removed from the fire hydrant while under pressure.
- 7.11.10.10. Hose and pumper nozzles shall be threaded with O-ring seals and retained by stainless steel screws.
- 7.11.10.11. Fire hydrants shall be cast marked, or the outside design shall be such that visible identification can be made as to type and design.
- 7.11.10.12. Fire hydrants shall have 5¼" main valves.
- 7.11.10.13. The valve seat removal wrench shall be a short pattern design and shall fit all depth of buries.
- 7.11.10.14. Depth of bury for fire hydrants shall be of the same as that specified for the pipe.
- 7.11.10.15. Fire hydrants shall have a valve between the hydrant and the main, located at the anchor tee, adjacent to the main.
 - 7.11.10.15.1. Fire hydrant laterals are to be no longer than 50'. Any hydrant lateral that exceeds 50' in length will require an upsize to 8" minimum with additional valves as necessary/required.
- 7.11.10.16. Fire hydrants at the end of mains shall have a maximum of 50' of 6" pipe between the reducer at the end of the main and the fire hydrant, including the valve.
- 7.11.10.17. All fire hydrants shall be provided with bolts and nuts consisting of 304 stainless steel, ASTM A 240 and ASTM A 666.

- 7.11.10.18. All fire hydrants shall be in accordance with AWWA C502.
- 7.11.10.19. Fire hydrants shall comply with the head flow/loss table as follows:

Maximum pressure loss allowable for two (2) 2½” hose connections and one (1) 4½” pumper connection:

<u>250 gpm (1 hose)</u>	<u>500 gpm (2 hose)</u>	<u>1,000 gpm (1 pumper)</u>
0.5 psi	1.1 psi	3.7 psi

Flow is based on a 5’ bury with a 6” diameter inlet.

- 7.11.10.20. Fire hydrants are to be covered with black fabric wrap or tagged out of service from the time of installation until the jumper assembly is removed and hydrant can be placed into service.
- 7.11.10.21. Fire hydrant services will be subject to Florida Department of Health (FDOH) bacteriological testing. No fire hydrant will be turned on until bacteriological tests are satisfied.
- 7.11.10.22. Fire hydrants shall also be approved by the governing fire control district (e.g. Bonita Springs Fire Control and Rescue District or Estero Fire Rescue).
- 7.11.10.23. The manufacturer shall provide certification of the fire hydrant’s standards to BSU.
- 7.11.10.24. All fire hydrants shall have a 10 year warranty.
- 7.11.10.25. All fire hydrants shall not be painted, unless otherwise directed by BSU. The factory yellow paint shall remain.

7.11.11. Fire Lines

- 7.11.11.1. PVC fire lines shall be DR14 class 305 pipe, and HDPE fire lines shall be DR11 pipe. 2” polytube fire lines shall be DR9. No galvanized pipe is permitted on fire lines.
- 7.11.11.2. Fire lines shall be connected directly to the water main and a backflow preventer shall be installed (see backflow preventer Standard Details). BSU personnel are required to be present at the time of connection.
- 7.11.11.3. All fire lines will be bacteriologically tested (by FDOH) from the main valve on the utility main to the backflow preventer.

- 7.11.11.4. Plan review, pressure testing, final inspections and acceptance shall be monitored and approved by the governing fire control district.
- 7.11.11.5. Pressure tests shall be directed by the governing fire control district and witnessed by BSU.
- 7.11.11.6. Separate main connections for fire lines are allowed.
- 7.11.11.7. Fire line backflow preventers and valves must be tagged UL approved per the governing fire control district.
- 7.11.11.8. BSU shall own and maintain the fire line from the connection at the main to and including the first gate valve adjacent to the water main. Ownership and maintenance of the fire line from the valve to the building, including the backflow preventer (regardless of size) is the responsibility of the customer.
- 7.11.11.9. Installation Requirements:
 - 7.11.11.9.1. For a fire line that is stubbed out for future connection, the fire line gate valve adjacent to the water main (i.e. BSU's end of ownership and maintenance) must remain closed until the fire line has been properly flushed, tested, and is ready for use. This gate valve shall not be operated by anyone other than BSU personnel.
 - 7.11.11.9.2. For a fire line that is ready for a full bore flush during source water main construction, BSU will authorize use of the water immediately (within 48 hours) following the source water main full bore flush, as long as it is properly scheduled in accordance with BSU's Fire Flow / Fire Line Flush Application.
 - 7.11.11.9.3. In order to protect the backflow preventer from potential debris during flushing, the backflow preventer may be removed during the flush of the upstream line (between the fire line gate valve adjacent to the water main and the backflow preventer).
 - 7.11.11.9.4. Chlorination and "swabbing" shall occur at the time of connection, followed by a mandatory 1 day bacteriological sample.

- 7.11.11.9.5. BSU will allow pressure testing of the fire line against the fire line gate valve adjacent to the water main, as long as the line is bacteriologically clear and chlorinated water is used for testing. The backflow prevention device must not be subjected to direct chlorination.
- 7.11.11.9.6. The backflow preventer must not be included in the pressure testing of the fire line, unless it is rated to meet the required pressure testing conditions.
- 7.11.11.9.7. If the fire line activation is anticipated to be required at the same time as source water main activation, flushing, pressure testing, and chlorination of the fire line up to the first OS&Y valve may occur along with the source water main testing. However, the assembly must be chained off to restrict tampering until turnover of the source water main to BSU is complete.
- 7.11.11.9.8. Fire line fittings up to the first OS&Y valve are to be epoxy lined (for potable water) to limit future water quality concerns.
- 7.11.11.9.9. In instances allowed by the National Fire Protection Association (NFPA), BSU requires the small diameter polyethylene fire line services to be red or colored from the ground level to the caps with red tape or paint.
- 7.11.11.9.10. All fire line gate valves designated as the end of BSU ownership and maintenance shall have locking valve box lids installed.

7.11.12. Water Services (BSU Standard Details W-12 and W-13)

- 7.11.12.1. All water services shall be either 1” or 2” in size, and are to be maintained by BSU.
- 7.11.12.1.1. Refer to the following table for possible meter and water service line combinations.

MAX. NUMBER OF METERS PER WATER SERVICE LINE SIZE

		Meter Size			
		5/8" x 3/4"	1"	1 1/2"	2"
Service Line Size	1"	2	1	-	-
	2"	4	2	1	1

- 7.11.12.2. Water services shall be run to all lots, perpendicular to the water main. At BSU's discretion where conditions dictate otherwise, BSU may approve non-perpendicular installation of water services.
- 7.11.12.3. Water services should be run to lot corners wherever possible.
- 7.11.12.4. Water service connections and other infrastructure should be located within minimum distances from power feeders and transformers as prescribed by the electric utility company.
 - 7.11.12.4.1. The Contractor shall not tap any water services prior to the electric company staking the proposed locations of transformers. **BSU WILL STRICTLY ENFORCE THIS PROVISION.** The water service is to be a minimum horizontal distance of 5' from power feeders or transformers, unless prior written approval from BSU is obtained. The separation is to be measured from the edge of the transformer pad to the water service connection. (BSU Standard Detail W-15)
- 7.11.12.5. Water service connections shall consist of the following:
 - 7.11.12.5.1. Stainless steel wrap around pipe saddle (double strap saddles are not permitted).
 - 7.11.12.5.1.1. Saddles shall be used for water services 2" and smaller.
 - 7.11.12.5.1.2. Saddles shall all be 304 stainless steel wrap around saddles.
 - 7.11.12.5.1.3. All water service taps shall be 1" or 2" in size.
 - 7.11.12.5.1.4. Water services larger than 2" shall be a cut-in or a hot tap, if approved in writing by BSU. If a hot tap is approved, the hot tap shall be constructed with a stainless steel MJ tapping sleeve and an iron body gate valve.
 - 7.11.12.5.2. All 1" water service lines shall be constructed with a 1" ballcorp corporation stop. Ballcorp corporation stops shall have AWWA iron pipe thread in the inlet side and a pack joint for polyethylene tubing on the outlet side.

- 7.11.12.5.3. All 2" water service lines shall be constructed with a 2" iron body gate valve with a 2" operation nut. Ballcorp corporation stops shall not be accepted for 2" service lines.
- 7.11.12.5.4. Polyethylene service tubing (including fire lines).
 - 7.11.12.5.4.1. Water service tubing will be DR9 C901 PE 4710 polyethylene tubing with ultra-violet inhibitors and lifetime warranty.
 - 7.11.12.5.4.2. All water service tubing for shall be blue in color; however, water service tubing whips for fire services shall be red or colored from the ground level to the caps with red tape or paint.
 - 7.11.12.5.4.3. Water service tubing shall meet the requirements of NSF Standards 14 and 61.
 - 7.11.12.5.4.4. 1" and 2" water services located under vehicular travel ways, as determined by BSU, shall be placed within a 3" and 4" sleeve/casing, respectively.
 - 7.11.12.5.4.4.1. The sleeve/casing shall extend 5' past the edge of the vehicular travel way and/or back of curb.
 - 7.11.12.5.4.4.2. The sleeve/casing shall be SCH40 PVC.
 - 7.11.12.5.4.4.3. Service sleeves/casings shall be finished with fabric wrap.
 - 7.11.12.5.4.5. Stainless inserts into poly tubes shall not be allowed.
 - 7.11.12.5.4.6. All water service lines shall have blue locator tape. Locator tape shall tie back to the water main line locator tape.
 - 7.11.12.5.4.7. Poly services shall not be coupled together; all services must be unaltered one piece (seamless) (as delivered from the manufacturer) from the tap to the meter location, terminating per BSU Standard Details.

- 7.11.12.5.5. Water service connections for HDPE pipe shall be made with electrofusion bonded taps or stainless steel wrap around saddles specifically approved for use with HDPE.
 - 7.11.12.5.5.1. HDPE electrofusion bonded taps shall comply with all requirements of NSF 14 and shall have ISO 9001 certification.
 - 7.11.12.5.5.2. All taps shall be rated for the same working pressure as the water main pipe being utilized.
 - 7.11.12.5.5.3. Electrofusion tapping tee and couplings shall provide a monolithic connection on the pipe.
 - 7.11.12.5.5.4. Installation shall be in strict compliance with manufacturer's requirements.
- 7.11.12.6. Master metered commercial developments (e.g. strip plazas, etc.) require the installation of a lockable ball valve on each unit's water service, located in an accessible location just outside the building.
- 7.11.12.7. Water Service Relocations / Abandonment
 - 7.11.12.7.1. The Owner/Developer/Contractor shall be responsible for relocation due to conflicts, including grade changes.
 - 7.11.12.7.2. Scenarios:
 - 7.11.12.7.2.1. If the project has been turned over to BSU and is no longer under warranty, BSU's Customer Service Department will provide a cost estimate for the proposed work. Once the cost estimate has been paid in full, BSU's Customer Service Department will create a work order for BSU to perform the relocation in house.
 - 7.11.12.7.2.2. If the project is still under construction and has yet to be turned over to BSU, the proposed relocation is to be submitted to BSU's Engineering Department for review and approval. Once approved, the work is to be performed by the Contractor and inspected by BSU.
 - 7.11.12.7.2.3. If the project has been turned over to BSU and is still under warranty, the proposed relocation is to be

submitted to BSU's Engineering Department for review and approval. Once approved, the work is to be performed by a Contractor hired by the warrantor and inspected by BSU. BSU will bill for inspection services based on BSU Tariff rates (1 man crew or 2 man crew hourly rates).

7.11.12.7.2.3.1. Procedures:

7.11.12.7.2.3.1.1. If the water service is to be relocated 5' or more from its original location, the poly water service is to be completely removed and the saddle is to be replaced with a repair clamp (for existing double strap saddle installations) or abandoned and plugged in place (for existing stainless steel wrap around saddle installations) with a ball marker installed. A new water service is to be tapped on the main in the desired location per these Specifications.

7.11.12.7.2.3.1.2. If the water service is to be relocated less than 5' from its original location, the poly water service is to be completely removed and replaced with an appropriately sized water service.

7.11.13. Meters and Meter Boxes

7.11.13.1. Water meters shall be sized, per AWWA M22, for each project per product and/or unit for residential use or per building and/or unit for commercial or industrial use.

7.11.13.1.1. It is the responsibility of the Engineer of Record to correctly size the meter(s) for any given lot/project. BSU will review the calculations for accuracy and to verify water service line adequacy. BSU will not dictate the meter size to be used; however, may make recommendations.

7.11.13.1.2. BSU does not use either 1/2" or 3/4" meters. BSU employs 5/8" x 3/4" meters as the smallest size available.

7.11.13.1.3. All meters 2" and smaller shall be provided, owned, and maintained by BSU. All meters larger than 2" shall be

provided by the applicant, but owned and maintained by BSU (per BSU's Tariff).

7.11.13.1.3.1. Meters larger than 2" shall be conveyed to BSU on the contributory assets during the turnover process.

7.11.13.2. Sub-metering is not permitted without prior written approval from BSU (per BSU's Tariff).

7.11.13.3. Appropriate meter boxes shall be utilized pending the size of the meter and whether or not a single, double, or larger box is required.

7.11.13.4. Meter boxes, shall be set at finished grade at the property line, installed by BSU.

7.11.14. Backflow Prevention (BSU Standard Details BF-1, BF-2, BF-3, and BF-5)

7.11.14.1. Backflow preventers shall be provided as required by the BSU Backflow Prevention Cross Connection Control Program.

7.11.14.2. Backflow prevention devices shall be sized for each project per unit for residential use or per building for commercial or industrial use.

7.11.14.3. Fire service line backflow prevention devices shall also be sized accordingly.

7.11.14.4. All proposed backflow prevention devices shall be referenced on the approved list located in the BSU "Backflow Prevention Cross Connection Control Program". Proposed backflow prevention devices not on the approved list shall require a Deviation Request to be submitted for review and approval. Only those on the approved list or meeting the criteria within the Program shall be allowed for service and connection to the BSU potable water system.

7.11.14.5. Backflow preventers to be used for fire lines and for jumper assemblies shall be in accordance with the BSU "Backflow Prevention Cross Connection Control Program" and per the governing fire control district.

7.11.14.6. Backflow preventers 2" and under on potable water service laterals and potable irrigation service laterals are provided, owned, and maintained by BSU (i.e. BSU ownership and

maintenance ends at the horizontal connection point of the 90 degree fitting at the customer's side of the backflow preventer); backflow preventers larger than 2" are to be provided by the Developer, and shall be privately maintained.

7.11.14.7. Backflow preventers on fire service lines, regardless of size, are not provided, owned, or maintained by BSU. BSU ends ownership and maintenance at the first gate valve adjacent to the water main on fire service lines.

7.11.14.8. All backflow preventers shall be provided with EPDM (ethylene propylene diene monomer) gaskets.

7.11.15. Manholes (BSU Standard Details SS-1, SS-3, SS-4, and SS-6)

7.11.15.1. Manholes shall be constructed at all changes in size, direction, or termination of sanitary sewers.

7.11.15.2. Multi-family residential or commercial/industrial buildings 2 stories and higher shall have a shallow manhole at the property line or easement line (see Standard Details) to facilitate the sanitary sewer connection.

7.11.15.3. Manholes with precast inverts may be allowed with written BSU approval, but must be submitted as a Deviation Request.

7.11.15.4. Offset/eccentric and/or flat top manholes are not permitted without prior written approval from BSU.

7.11.15.5. A minimum line drop of 0.10' shall be designed across each manhole. A minimum line drop of 0.05' across each manhole is required for acceptance after construction.

7.11.15.6. Manholes cored to receive discharge from sanitary sewer force mains shall be brought to current specifications, including but not limited to recoating the entire manhole with an approved protective lining, or the coating shall be repaired around the core if the existing coating meets current specifications.

7.11.15.7. All pressure mains, services, and other conduits, including casings, shall maintain a minimum 5' separation from all manholes, edge-to-edge.

7.11.15.8. All manholes shall have as few joints as possible and shall be constructed per the following table.

- 7.11.15.8.1. Note that the table lists a minimum 2' base section. An 18" cone is only listed for shallow manholes; however, it can be utilized on any manhole with adjustments made to the base or barrel section accordingly.
- 7.11.15.8.2. The first entry in the table is for a shallow manhole with a shallow ring & cover. The shallow ring & cover height is 3".
- 7.11.15.8.3. The base height includes bottom slab thickness.
- 7.11.15.8.4. The core is assumed to be 12" and located 1" above the top of the bottom slab.
- 7.11.15.8.5. The height of the 8" invert is assumed to be 3" above the top of the bottom slab.
- 7.11.15.8.6. The standard ring & cover height is 7".
- 7.11.15.8.7. The maximum allowable chimney height is 24", which includes the ring & cover, adjustment rings, and internal neck that is precast with the cone.
- 7.11.15.8.8. No adjustment is required (i.e. the ring and cover can be installed directly on top of the cone); however, if adjustment is needed, the maximum allowable adjustment is 12" and the minimum size adjustment ring allowed is 2".
 - 7.11.15.8.8.1. Please note, the maximum allowable adjustment may not be allowed if the maximum allowable chimney height will be exceeded (i.e. if the internal neck in the cone of the manhole exceeds 5").
 - 7.11.15.8.8.2. If the maximum allowable chimney height is exceeded, either the cone, mid-section or base (or combination thereof) of the manhole is to be replaced to meet BSU requirements.
 - 7.11.15.8.8.3. Adjustment rings must have uniform I.D.'s and O.D.'s.
- 7.11.15.8.9. The cut is calculated as follows:

$$\begin{aligned} \text{Cut} &= \text{Base} + \text{Barrel} + \text{Cone} + \text{Ring \& Cover} \\ &\quad - \text{Bottom Slab Thickness} - \text{Top of Bottom Slab to Invert} \end{aligned}$$

Bottom Slab Thickness (inches)	Required Manhole Section Depth (feet)			# of Joints	Minimum Depth of Invert to Finished Grade (Cut) (feet)
	Base	Barrel	Cone		
8	2		1.5	1	2.83
8	2		2	1	3.67
8	3		2	1	4.67
8	4		2	1	5.67
8	5		2	1	6.67
8	6		2	1	7.67
8	7		2	1	8.67
8	7		3	1	9.67
8	8		3	1	10.67
8	8	2	2	2	11.67
12	8	2	3	2	12.33
12	8	3	3	2	13.33

7.11.15.9. All manholes shall be concentric and shall conform to the requirements of ASTM Designation C478, with reinforcement of Grade 40 and the following modifications:

7.11.15.9.1. The minimum wall thickness shall be 8”.

7.11.15.9.2. All concrete shall be Type 2 Portland cement and shall attain a minimum compressive strength of 4,000 psi in 28 days. Concrete shall be vibrated following placement to prevent the formation of honeycomb, to force out air pockets, and to work the mixture around the reinforcing steel.

7.11.15.9.3. Reinforcing steel shall be intermediate grade new billet stock with deformations conforming to ASTM A 305-53-7 and A 15-54T. Reinforcing steel shall be clean and free from loose scale, rust, dirt, and oil. Reinforcing steel shall be placed in accordance with the ACI Manual of Detailing, and all bars shall be lapped 24 bar diameters unless otherwise noted. All reinforcing steel shall have a minimum of 3” of clearance from the edge of the concrete. Spacing dimensions shown in the Standard Details are from the centerline of the bars.

7.11.15.9.4. All manhole joints between the frame and adjusting rings, and tongue and groove of multi-piece units, shall have

BSU approved gaskets. All joints shall have non-shrink grout on the interior and shall be wrapped with an approved joint wrap on the exterior.

- 7.11.15.9.5. All grout used for sealing around pipe openings and joints shall be of a type acceptable to BSU and designed for use in water.
- 7.11.15.9.6. Lifting holes through the structure are not permitted.
- 7.11.15.9.7. The design of the structure shall include a precast base of not less than 8" in thickness poured monolithically with the bottom section of the manhole walls.
- 7.11.15.9.8. Manhole tops shall terminate at such an elevation as to allow for adjustment under the manhole frame and cover and to make allowance for the street grade or final ground elevation. Adjustment to street grade shall be made with precast concrete adjusting rings or approved alternative. Brick adjustment is not permitted.
- 7.11.15.9.9. A concrete collar shall be required where manholes are constructed in unpaved areas or at any other locations at the discretion of BSU. (BSU Standard Detail SS-8)
- 7.11.15.9.10. Drop connections, where required on precast manholes, shall be manufactured with the manhole elements at the casting yard. Field construction of drop manholes shall be allowed only with prior written approval from BSU.
 - 7.11.15.9.10.1. A drop connection is required anywhere the invert in elevation is 16" or greater than the invert out elevation.
 - 7.11.15.9.10.2. Drop inverts are to be labeled on the construction plans as well as the as-built record drawings.
- 7.11.15.9.11. All manholes shall be coated with a protective lining and shall be applied in strict accordance with the manufacturer's specifications. Note that the specifications may differ for new versus rehabilitation applications. All manhole coatings shall have a warranty of 10 years on all workmanship and products, and shall protect the structure for a minimum of 10 years from all leaks or failure from exposure to corrosive gases. Coatings shall be applied by a company with a minimum of 10 years of experience

installing coatings in manholes. In preparation for coating, the surface shall be sand blasted, cleaned, and dried prior to initial painting. The surface shall be inspected by BSU for leaks prior to painting.

- 7.11.15.9.11.1. Wherever/whenever the situation dictates repair (e.g. core bores, etc.) and not a full recoat of an existing manhole coating/lining, the coating/lining utilized for the repair shall be like for like with the existing.
- 7.11.15.9.12. All flow line channels shall have a minimum thickness of 2" of poured concrete and be of the same diameter as the pipe (8" minimum). Filler in the bottom of the manhole shall be concrete, must have a tapered trough, and shall be sloped smoothly and evenly. A concrete bench shall be constructed to the height of the crown of the highest pipe to direct flow and to allow for the passage of a camera for video inspection purposes. The trough in all end manholes and shallow manholes shall be a minimum of 32" in length to accommodate a video camera. Gravel, sand or brick filler in the bottom of manholes shall not be allowed.
 - 7.11.15.9.12.1. Any evidence of ponding will require the flow channel to be reworked to eliminate the problem.
- 7.11.15.9.13. The Contractor shall furnish a flexible rubber sleeve with a stainless steel clamp to provide a leak-proof joint between the concrete manhole and all pipes entering the manhole.
- 7.11.15.9.14. Pipes shall be cut flush with or within 2" of the inside wall of the manhole.
- 7.11.15.10. The manhole trench shall be excavated in accordance with the Excavation, Trenching, Backfilling, and Restoration section of these Specifications.
- 7.11.15.11. The manhole base section shall be placed on a compacted base of sand and/or gravel, no larger than #57 stone.
- 7.11.15.12. Manhole Testing
 - 7.11.15.12.1. Manholes shall be visually inspected for leak(s). Any leak(s) shall be sealed and resealed until leak(s) are eliminated.

7.11.15.12.2. Spark testing of coatings shall be performed by the Developer when required by BSU.

7.11.15.13. Location of a manhole core bore must allow for 4" minimum from the outside diameter of the core to the nearest joint to ensure structural stability and a good seal by the joint wrap.

7.11.16. Castings (BSU Standard Detail SS-7)

7.11.16.1. Castings for manhole frames, covers, and other items shall conform to the ASTM Designation A48, Class 30.

7.11.16.2. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended.

7.11.16.3. The seating surfaces between frames and covers shall be machined to fit true so the frames and covers do not shift under traffic conditions or permit entry of storm drainage.

7.11.16.4. Lifting or "pick" holes shall be provided, but shall not penetrate the cover.

7.11.16.5. The cover shall be a BSU logo casting, with the exception of covers for grease interceptors.

7.11.16.6. All manhole frames and covers shall be traffic bearing unless otherwise specified and shall include O-rings permanently mounted in the covers.

7.11.16.7. The standard frame and cover shall be USF 420 Type EP, and the shallow manhole frame and cover shall be USF 440 Type EP-ORS.

7.11.16.8. Frames and covers shall be fully bedded in mortar to the correct finish grade elevation conforming to the standard drawings.

7.11.17. Sanitary Sewer Lines

- 7.11.17.1. Sanitary sewer shall be sized to provide ample capacity for the required peak flow rates.
- 7.11.17.2. The minimum allowable size for any sanitary gravity sewer, other than service connections, shall be 8" in diameter, SDR26.
- 7.11.17.3. All sanitary gravity sewer shall be designed at slopes providing minimum velocities of not less than 2 fps when flowing full, based on Manning's formula. No constructed slope will be accepted for service that is more than 10% lower than the minimum design slope. The following minimum slopes shall be used as a design guideline (minimum design slopes less than those indicated shall not be considered):

<u>SANITARY SEWER PIPE DIAMETER (Inches)</u>	<u>MINIMUM DESIGN SLOPE (Feet per 100 Feet)</u>
8"	0.40%
10"	0.28%
12"	0.22%
15"	0.15%
18"	0.12%

- 7.11.17.4. Sanitary gravity sewers shall be installed with straight alignment and grade between manholes with manhole spacing not to exceed 400'.
- 7.11.17.5. All 8" sanitary gravity sewer must commence and terminate in a manhole.
- 7.11.17.6. All sanitary gravity sewer between 2 manholes shall be 8" diameter (minimum). This includes lines between shallow manholes and main line manholes.
- 7.11.17.7. For multi-family and commercial development, any sanitary gravity sewer line servicing multiple buildings must be 8" diameter. (BSU Standard Detail SS-25)
- 7.11.17.8. The angle of flow between sanitary gravity sewer lines shall not be less than 90 degrees without written BSU approval.
- 7.11.17.9. Sanitary gravity sewer line size changes shall occur only at manholes. Where different pipe sizes join in a manhole, the pipes are to be placed at elevations where the 0.8 depth points are equal, unless higher points are required.

- 7.11.17.10. Sanitary gravity sewer system equalizers/overflows shall be installed from manhole to manhole, as directed by BSU. At least 1 equalizer/overflow pipe shall be provided for each pump station area. This shall apply for new system design adjacent to older systems as well as new developments with multiple pump stations.
 - 7.11.17.10.1. No influent is permitted into an equalizer/overflow sanitary gravity main or manhole.
 - 7.11.17.10.2. Equalizer/overflow sanitary gravity mains and manholes are to be labeled on the plans.
 - 7.11.17.10.3. The upstream invert of the equalizer/overflow main must be lower than all manhole rim elevations within that particular sanitary gravity sewer drainage basin.
- 7.11.17.11. Protection of sanitary sewer lines shall be provided when design velocities are greater than 6 fps.
- 7.11.17.12. All sanitary gravity sewer stubs from previous development must be verified for usability (e.g. adequate slope, no conflict with other infrastructure, no prior damage to the stub, no dips exist outside of BSU's specified limit, etc.) prior to any extension to such being allowed. If the stub is not acceptable for use, it shall be replaced at the current Developer's cost. All sanitary gravity sewer stubs acceptable for use shall also be included in the low pressure air test and video inspection after the new system connection has been completed.
- 7.11.17.13. No sanitary gravity sewer connections are permitted to master pump stations.

7.11.18. Sanitary Gravity Sewer Fittings

- 7.11.18.1. Sanitary gravity sewer fittings shall be PVC and shall conform to the requirements of the ASTM D-3034 standard with a minimum wall thickness of SDR26.
- 7.11.18.2. Sanitary gravity sewer fittings 8" and smaller shall be molded in 1 piece with elastomeric joints with a "locked in" design and minimum socket depths as specified in ASTM D-3034. Any molded fittings without the molded locked in design will be rejected.

- 7.11.18.3. Sanitary gravity sewer fittings 10" and larger shall be molded or fabricated in accordance with ASTM D-3034, with manufacturers standard bells and gaskets.
- 7.11.18.4. Gaskets shall have minimum cross sectional area of 0.20 in² and conform to the ASTM F-477 standard.
- 7.11.18.5. PVC material shall have a cell classification of 12454-B as defined in ASTM D-1784.
- 7.11.18.6. PVC sanitary gravity sewer fitting and gasket materials shall conform to all ASTM standards stated in the above specifications as well as ASTM F-1336, ASTM D-3212 and ASTM F913.

7.11.19. Sanitary Sewer Service Laterals (BSU Standard Detail SS-10)

- 7.11.19.1. Sanitary sewer service laterals greater than 50' in total length require specific BSU approval in writing. Service laterals shall not exceed 150' in total length including clean outs.
- 7.11.19.2. Sanitary sewer service laterals shall be a minimum of 6" in diameter with a minimum slope of 1%.
- 7.11.19.3. Sanitary sewer service lateral connections shall be located at the center of lots, unless otherwise approved in writing by BSU.
- 7.11.19.4. Double sanitary sewer service laterals are not permitted without prior written approval from BSU.
- 7.11.19.5. Sanitary sewer service laterals are to be connected perpendicular to the sanitary gravity sewer main utilizing a tee wye fitting.
- 7.11.19.6. Sanitary sewer service laterals are allowed to connect directly to manholes.
 - 7.11.19.6.1. The angle of flow cannot be less than 90 degrees, and the angle between the sanitary sewer service lateral and any other influent mains or laterals cannot be less than 45 degrees.
 - 7.11.19.6.2. A maximum of 4 influent lines will be permitted per manhole.
 - 7.11.19.6.3. Sanitary sewer service laterals connecting to manholes must connect at an elevation 6" above the invert out of the

manhole. The 6" invert at the manhole must be labeled on the plans.

7.11.19.6.4. Drop connections for sanitary sewer service laterals are not permitted without prior written approval from BSU. If permitted, new construction requires an external drop connection. An internal drop connection will only be considered for a sanitary sewer service lateral connecting to an existing manhole.

7.11.19.7. For non-residential development, BSU shall require low pressure air testing all the way to the building, including infrastructure not to be owned and maintained by BSU.

7.11.19.8. Sanitary sewer service laterals not used for service connections shall be capped 2' below grade, and a ball marker shall be installed for future location. Sanitary sewer service laterals to be capped shall be approved in writing by BSU. Sanitary sewer service laterals to be permanently abandoned shall be cut and capped at the back of the curb with a ball marker installed.

7.11.19.9. Sanitary sewer service laterals are to be SDR26.

7.11.20. Clean Outs (BSU Standard Detail SS-9)

7.11.20.1. Sanitary sewer clean outs shall be provided at the edge of the right-of-way or easement for all service connections. Once the temporary stub-out for the service connection pipe is removed, the permanent clean out assembly shall be installed. Unless otherwise dictated by BSU, the Permanent Service clean out assembly with a steel ring and cover and concrete collar is to be installed for dedication to BSU.

7.11.20.2. Clean outs shall be installed every 50' along service laterals longer than 50'.

7.11.20.3. Clean outs shall be installed at each change in direction.

7.11.20.4. Concrete pads with rebar shall be installed for all clean outs per the Standard Details, except those that reside in paved areas. Clean outs that reside in areas with brick pavers can have the brick pavers cut around the ring and cover for a cleaner installation. Clean outs in concrete driveways or sidewalks can have the concrete poured seamlessly around the ring and cover, eliminating the pad.

- 7.11.20.5. Clean outs within industrial areas, some commercial areas, or at the discretion of BSU shall consist of a shallow manhole for water quality sampling purposes. For existing developments approved prior to this requirement, existing clean outs shall be replaced at the Developer's expense with shallow manholes, per this requirement.
- 7.11.20.6. Sanitary sewer force mains that are susceptible to sedimentation clogging created by depressed crossings or extended low flow and low velocity periods, shall be provided with suitable clean out connections. Clean out connections shall be located to facilitate the required maintenance operations.
- 7.11.20.7. Clean out stacks/riser pipes are to be seamless.
 - 7.11.20.7.1. Connections to the stack/riser pipe of the clean out are strictly prohibited.
 - 7.11.20.7.2. No private connections to the sanitary sewer are permitted until turnover has been completed.
 - 7.11.20.7.3. A 24"x24" zone behind the plug for private service connections at the base of the clean out must be clear of all other utilities and obstructions so as to allow for ease of installation of the private connection.

7.11.21. Pump Stations (BSU Standard Details PS-2, PS-11, and PS-12)

- 7.11.21.1. Pump stations may not be permitted when an existing station is in hydraulic proximity. The Developer may be required to update an existing station to facilitate the proposed flow. BSU shall solely determine the limit of hydraulic proximity.
- 7.11.21.2. For pump stations with a design maximum flow of 1,500 gpm or less, a minimum of 2 pump units shall be provided. Where the peak design flow exceeds 1,500 gpm, 3 or more units shall be provided, such that the design maximum flow can be pumped with the largest unit out of service. The selected sewage pump system shall be capable of pumping the design maximum flow at the maximum computed system total head requirements. Additionally, final selection shall be based upon optimal operating costs.
- 7.11.21.3. All re-pump stations shall require odor control and emergency generators. Odor control and generator equipment specifications shall be provided to BSU for written approval. BSU may require

an emergency generator and/or odor control at other locations deemed appropriate (e.g. master pump stations).

7.11.21.4. The pump station electrical service, from the transformer to the electric meter at the pump station, is to be owned and maintained by BSU. It shall be included on the Contributory Assets at project turnover. The pump station electrical service shall also be covered by and centered within a 15' wide easement, granted to BSU.

7.11.21.4.1. The electrical service shall be 3 Φ . For pumps 14 hp or greater, the electrical service shall be 460 V.

7.11.21.5. Hydraulic Computations

7.11.21.5.1. Head capacity curves shall be prepared for the proposed pumping system in order to determine the various operational conditions. Hydraulic computations shall be in accordance with standard engineering formulas with pipe friction loss calculated by the Hazen-Williams equation, using standard friction factors based on the material utilized. Age of the material is to be considered when determining the correct friction factor to be utilized. The system head capacity analysis shall provide the following, at a minimum, and be subject to review and approval by BSU:

7.11.21.5.1.1. System operation under peak flow conditions with 1 pump or multiple parallel pumps, pumping as designed. If the receiving sanitary sewer force main systems are interconnected to additional pump stations, hydraulic design conditions shall also include said pumping systems operating at rated capacity. At BSU's discretion, system evaluation shall be done at current manifolded sanitary sewer force main flows as well as planned flows.

7.11.21.5.1.2. Pumping capability with 1 pump running, all units operating in parallel and other combinations, if applicable.

7.11.21.5.1.3. For multiple pump station sanitary sewer force main systems, the 1 pump maximum capacity under minimum flow contribution conditions from the other connected facilities shall be calculated.

7.11.21.6. Wet Well Design (BSU Standard Details PS-6 and PS-10)

- 7.11.21.6.1. The maximum depth to the invert of an influent sanitary gravity sewer main into the wet well shall be 12.00' below finished grade.
- 7.11.21.6.2. The maximum depth of a pump station wet well shall be 20.00' below finished grade.
- 7.11.21.6.3. The wet well structure shall have design capacity to allow a maximum of 7 starts per hour under normal operating conditions (i.e. design average flow). The minimum diameter of the wet well is 6'.
- 7.11.21.6.4. Low water levels shall be set to provide adequate submergence for facilities to preclude inlet vortexing and air binding. In general, the normal operational water level shall provide positive suction head for the pumps. Maximum water levels shall not exceed the invert elevation of the lowest influent pipe with the high water alarm no higher than 0.8' below the invert of said pipe. There shall be a minimum distance of 3' from the high water alarm (i.e. 0.8' below the lowest influent invert) to the low level shutoff. Pump size may increase this distance.
- 7.11.21.6.5. A baffle may be required to prevent turbulent flow conditions at the pump inlet, at the discretion of BSU.
- 7.11.21.6.6. Pump bays or knee walls for larger pumps ($\geq 3,200$ gpm) may be required to prevent hydraulic interference from adjacent operating pumps, at the discretion of BSU.
- 7.11.21.6.7. A divided wet well may be required for pump stations with 4 or more pumps for isolation, cleaning, and inspection purposes, at the discretion of BSU.
- 7.11.21.6.8. Computational fluid dynamics (CFD) analysis may be required for larger stations, at the discretion of BSU.
- 7.11.21.6.9. Preliminary location of all wet wells and appurtenances within the 30'x30' easement shall be provided by BSU at the time of final plan submittal and review. Final determination for the location of the wet wells and appurtenances within the 30'x30' easement shall be discussed at the pre-construction meeting and in the field

with appropriate BSU personnel prior to setting the wet well.

- 7.11.21.6.10. The structure shall be circular and shall be constructed of poured in place concrete or precast concrete sections (ASTM C478).
- 7.11.21.6.11. The top slab shall be suitable for AASHTO H-20 / HS-20 traffic loading and the wet well shall be designed to prevent floatation.
- 7.11.21.6.12. The top slab shall be 8" thick, and include a vent hole located between the header pipes.
- 7.11.21.6.13. Precast concrete wet wells 6' in diameter shall also be provided with an 8' minimum precast base section. The base section can be precast in 2 pours with a waterstop for the joint between the base and wall sections, or can alternatively be monolithically poured. Precast sections above the 8' base section shall be a minimum of 2' in depth, and shall be in multiples of 8' to the required depth to minimize joints. Larger concrete wet wells shall be designed and detailed by the Engineer of Record, and are subject to review and approval by BSU.
- 7.11.21.6.14. All joints shall have gaskets. All joints shall have non-shrink grout on the interior and shall be wrapped with joint wrap on the exterior.
- 7.11.21.6.15. The pump station wet well shall be coated with a protective lining per the manufacturer's specifications. Note that the specifications may differ for new versus rehabilitation applications. The warranty for the lining or coating on the pump station wet well shall be 10 years minimum. The surface for any coating shall be prepared by sand blasting prior to initial painting. The surface shall be clean and dry, and shall be inspected by BSU for leaks prior to painting.
- 7.11.21.6.16. Spark testing of coatings shall be performed by the Developer when required by BSU.
- 7.11.21.6.17. Pump station piping shall include a 4" (minimum) HDPE SDR 11 header pipe. The header pipe shall have HDPE mechanical joint flange adapters with stainless steel flanges, which shall also be used to connect the header to the pump foot piece. The header pipe shall have an air

release valve attached to the HDPE pipe with a pre-fabricated 4"x2" tee. (BSU Standard Details PS-7 and PS-8)

7.11.21.6.18. Stabilizing brackets for the header piping shall be required by BSU on all installations. A 2 bracket system, minimum shall be required for all pump stations. Deeper pump stations shall require additional brackets at the discretion of BSU. The Engineer of Record and Contractor shall coordinate this requirement with BSU personnel prior to the wet well installation. A bracket system shall be constructed utilizing a single 2"x2" "L" channel. The header piping shall be connected to the bracket with $\frac{3}{8}$ " stainless steel U-bolts and nuts. The bracket shall be connected to the wet well with $\frac{3}{8}$ " stainless steel threaded rod and nuts. All stainless steel shall be Type 316. (BSU Standard Detail PS-13)

7.11.21.6.19. Discharge header piping shall also include a 4" iron body plug valve with non-lubricated nickel iron, a neoprene coated plug, and a 100% opening (100% port), complete with a wrench, a 4" flanged iron body check valve, and a 3-way iron body flange, lever activated plug valve. The 3-way valve shall be mounted so that the 3rd port is on top. The 3rd port shall have a 3" quick coupling unit connected with a bronze male thread adapter, and shall have a 2 handle bronze locking cap. The threaded port shall have a stainless steel valve actuator to back-flush the check valve. All valves shall be painted hunter green with UV resistant polyurethane paint. (BSU Standard Details PS-7 and PS-8)

7.11.21.7. Types of Pump Station Construction

7.11.21.7.1. Submersible Facilities

7.11.21.7.1.1. Submersible sewage pump stations shall be constructed where the peak design flow is less than 2,000 gpm unless otherwise directed by BSU. These facilities shall be constructed in accordance with all applicable provisions of this standard. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps, motors, hatch covers, and controls as specified.

7.11.21.7.2. Built-In-Place Facilities

- 7.11.21.7.2.1. Structural built-in-place sewage pump stations may be required to be constructed where the peak design flow exceeds 2,000 gpm or as directed by BSU. Additionally, where the peak flow requirement is more than 1,500 gpm 3 pumping units shall be included. These facilities shall be constructed in accordance with all applicable provisions of this standard. Preliminary design submittals are required for facilities of this type.

7.11.21.8. Site Design Considerations (BSU Standard Detail PS-5)

- 7.11.21.8.1. Pump Stations shall be installed off of the right-of-way within readily accessible sites, unless otherwise approved by BSU, and shall have adequate area provided for operation and maintenance of the facility. An easement approximately 30'x30' feet is generally adequate for normal size pump station facilities. BSU will specify the required size for master pump station easements. The site shall be well drained, at or above the elevation designated as the 100 year water surface elevation.
- 7.11.21.8.2. Site preparation shall include a minimum 15' wide bituminous pavement or concrete driveway for unimpeded ingress/egress to the pump station for good all weather operations. Pump station entrances shall also comply to support H-20/HS-20 loading specifications. BSU does not permit porous pavers (e.g. Geoblock, etc.). The length of BSU's Vac-Con® (approximately 40') should be considered when designing the layout of the access driveway for accessibility of the truck and also to not hinder traffic when BSU performs routine maintenance. The pump station access driveway is owned and maintained by BSU, and its cost shall be included with the total cost of the pump station as listed with the Contributory Assets at turnover.
- 7.11.21.8.3. Landscaping around pump stations shall be in accordance with the provided landscaping plan. An enclosure shall be required per Florida Administrative Code 62-604.400(2)(d). Landscape and electrical plans shall be submitted if they are different from BSU Standard Details.

7.11.21.9. Sewage Pumps and Motors

- 7.11.21.9.1. Sewage pumping units shall be capable of handling raw, unscreened sewage and shall be capable of passing a sphere of at least 3" in diameter.
- 7.11.21.9.2. Pumps shall be electric motor driven and of a proven design that has been in sewage service under similar conditions for at least 5 years.
- 7.11.21.9.3. Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation without overloading the motors.
- 7.11.21.9.4. Pump motors shall be dual voltage, 230/460 V, 3 Φ , 60 cycle electric motors. Pump stations with motors greater than 14 hp shall be 460 V electric motors. The Contractor shall verify the local voltage prior to placing an order for the pumps. The voltage requirement shall be coordinated with the electric company based upon BSU approved pump motor sizing.
- 7.11.21.9.5. All pump stations shall be grounded with a minimum of two (2) 10' copper ground rods no less than 6' apart, and shall have a measurement of 5 Ω or less.
- 7.11.21.9.6. The electric meter post shall be located outside of the landscaped area and fence and shall also be within 10' of the control panel with the meter to be facing away from the station. The location is to be reviewed and approved by BSU prior to placing the meter. (BSU Standard Details PS-5 and PS-9)
- 7.11.21.9.7. A ½" thick 316 stainless steel pump discharge base plate shall be installed at the bottom of the wet well under each pump to prevent damage to the wet well base due to pump vibration. The plate(s) are to be affixed with hydraulic cement. A single, larger plate may be utilized under all pumps in lieu of separate plates for each pump. (BSU Standard Detail PS-16)
- 7.11.21.9.8. Submersible Pumps**

- 7.11.21.9.8.1. The pump units shall be non-clog, mechanical seal, submersible sewage pumps. Certified pump curves shall be furnished with the pumps.
- 7.11.21.9.8.2. Pumps shall be capable of handling raw, unscreened sewage.
- 7.11.21.9.8.3. The design shall be such that pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection.
- 7.11.21.9.8.4. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fasteners to be removed for this purpose, and shall not require personnel to enter the pump station wet well.
- 7.11.21.9.8.5. Each pump shall be fitted with a $\frac{3}{8}$ " Type 316 stainless steel chain that is a minimum of 18" long attached to a $\frac{1}{4}$ " minimum Type 316 stainless steel wire rope which is to be hung on a rack at the top of the wet well.
- 7.11.21.9.8.6. The stator casing, oil casing and impeller shall be of gray iron construction with all parts coming into contact with sewage protected by a coat of rubber asphalt paint.
- 7.11.21.9.8.7. All external bolts and nuts shall be of stainless steel.
- 7.11.21.9.8.8. A wear ring designed for abrasion resistance shall be installed at the inlet of the pump to provide protection against wear to the impeller.
- 7.11.21.9.8.9. The impeller shall be of a single vane, non-clog design, capable of passing solids, fibrous material and heavy sludge, and constructed with a long throughway with no acute turns.
- 7.11.21.9.8.10. All pumps shall have a rotating stainless steel impeller wear ring as well as a stationary casing wear ring.
- 7.11.21.9.8.11. A sliding guide bracket and bar system shall be an integral part of the pumping unit. The sliding guide

bracket and bar system shall be constructed of schedule 40, 316 stainless steel consisting of one-piece, monolithic guide rails. Interim Stabilizing brackets shall be installed every 10' maximum, with a minimum of 2 brackets installed.

7.11.21.9.8.12. The pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connecting flange without the need of any bolts or nuts.

7.11.21.9.8.13. Sealing of the pumping unit 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 2 guide bars to and pressing tightly against the discharge connection; no portion of the pump shall bear directly on the floor of the sump and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm, O ring or similar method of sealing will not be accepted as an equal to a metal contact of the pump discharge and mating discharge connection specified and required.

7.11.21.9.8.14. Pump motors shall be housed in an air filled watertight casing and shall have Class F insulated windings, which shall be moisture resistant. The motor shall be NEMA Design B rated at 155°C maximum. Pump motors should 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 totally dry condition. The cable junction box and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor from any water or solids gaining access through pump top. All pumps shall be equipped with a shaft seal failure indicator.

7.11.21.9.8.15. The pump motor cable shall be suitable for submersible pump applications and this shall be permanently indicated on the cable. The pump cable shall be 40' in length.

- 7.11.21.9.8.16. The pump manufacturer shall perform the following tests on each pump before shipment from the factory:
- 7.11.21.9.8.16.1. The pump shall be meggered for insulation breaks and/or moisture.
 - 7.11.21.9.8.16.2. Prior to submergence, the pump shall be run dry and checked for correct rotation.
 - 7.11.21.9.8.16.3. The pump shall be run for 30 minutes in a submerged condition.
 - 7.11.21.9.8.16.4. The pump shall be removed from the test tank and meggered immediately for moisture. Oil plugs shall be removed to check the lower seal. The inspection plug shall be removed to check the upper seal and possible water intrusion of the stator housing.
 - 7.11.21.9.8.16.5. A written certified test report giving the above information shall be supplied with each pump at the time of shipment.
 - 7.11.21.9.8.16.6. All ends of pump cables will then be fitted with a rubber shrink fit boot to protect the cable prior to electrical insulation.
- 7.11.21.9.8.17. The pump manufacturer shall warrant the pumps being supplied to BSU against defects in workmanship and materials for a period of 5 years under normal use, operation and service. In addition, the manufacturer shall replace certain parts (e.g. mechanical seal, impeller, pump housing, wear ring and ball bearings) which shall become defective through normal use and wear on a progressive schedule of cost for a period of 5 years. The warranty shall be in published form and apply to all similar units.
- 7.11.21.9.8.18. The pump manufacturer shall supply with the original equipment the following spare parts and equipment for each pump:

- 7.11.21.9.8.18.1. Two (2) sets of bearings.
- 7.11.21.9.8.18.2. Two (2) sets of seals.
- 7.11.21.9.8.18.3. One (1) spare Ultra Sonic Level Indicator (Transducer).
- 7.11.21.9.8.18.4. All spare fuses.
- 7.11.21.9.8.18.5. Two (2) sets of wear rings (if required by the particular pumps being utilized).
- 7.11.21.9.8.18.6. Two (2) sets of impellers.
- 7.11.21.9.8.18.7. Two (2) Liquid Level Regulators (Float Balls).

7.11.21.10. Pump Controls (BSU Standard Details PS-3 and PS-4)

- 7.11.21.10.1. Each pump station shall include a Telemetry Control Unit (TCU) to provide automatic level control and pump operation. The TCU shall be equipped with an internal radio, compatible with BSU's existing telemetry system to provide data communication and remote pump control via telemetry. The TCU shall be wired to provide monitoring of incoming power (i.e. voltage and phase rotation).
- 7.11.21.10.2. Electric panels shall be stainless steel with a NEMA 4X rating, shall be a free standing enclosure, shall be of the type recommended by the pump manufacturer and shall be compatible with the requirements of the pumping operation.
- 7.11.21.10.3. All electrical panels shall be installed at the 100 year flood elevation, minimum.
- 7.11.21.10.4. The panel shall have double dead front outer doors fitted with hoop and padlock master keyed to BSU's standard.
- 7.11.21.10.5. Electric Panels shall be outfitted with a sized, fused disconnect located at rear of the panel for NFPA 70E compliance.
- 7.11.21.10.6. A sign shall be affixed to the control panel, clearly visible from the gate stating: "IN CASE OF EMERGENCY CONTACT BSU (239) 992-0711". (BSU STANDARD DETAIL PS-14)
- 7.11.21.10.7. Electric Panel shall include lightning arrestors.
- 7.11.21.10.8. Electric Panel shall include a 200 amp generator receptacle with an angle adapter.

- 7.11.21.10.9. Two (2) liquid level regulators (float balls) shall be provided as redundancy, one (1) set above the high level alarm elevation and one (1) set at the pump OFF elevation. These regulators shall be normally open and shall be provided with 40' of electrical cable. The regulators shall be wired as ON/OFF for emergency pumping.

7.11.21.11. Variable Speed Pump Control Systems

- 7.11.21.11.1. The requirement for variable speed controlling of sewage pumps shall be considered for all large capacity pumps for major installations, when the hydraulic conditions indicate a necessity for variable speed control, or at the discretion of BSU.
- 7.11.21.11.2. The requirement for variable speed pump controls shall receive prior review with BSU. Should a variable speed control system be necessary, the facility shall be equal to existing variable speed control units, or as approved by BSU.

7.11.21.12. Telemetry System

- 7.11.21.12.1. All sewage pump stations shall be required to be equipped for and connected with the master BSU remote telemetry system. The installation shall be compatible with the existing BSU system and must monitor pump ON/OFF, communications failure, and pump failure. Pump control via telemetry is required.

7.11.21.13. Emergency Pump Connections

- 7.11.21.13.1. All sewage pump stations, whether equipped with stationary standby power generators or not, shall have connections provided for emergency auxiliary pumping through a 3-way valve with quick-lock couplings.

7.11.21.14. Emergency Generators

- 7.11.21.14.1. Installation shall be an engine generator, fuel oil operated of adequate size to automatically start after a power outage and operate the pumps required for design flow conditions, lights, controls and other critical items.

- 7.11.21.14.2. Fuel storage shall be provided for all emergency generators in a belly storage tank with a minimum volume to provide 24 hours of operation.
- 7.11.21.14.3. All alarms and controls shall be provided with telemetry points.
- 7.11.21.14.4. The engine generator sizing for the application and the installation shall be in accordance with all applicable manufacturers' requirements.
- 7.11.21.14.5. All pump stations shall be provided with emergency generator receptacles.
- 7.11.21.14.6. All re-pump stations shall be equipped with an emergency generator, unless otherwise directed by BSU.

7.11.21.15. Odor Control

- 7.11.21.15.1. Re-pump stations and non-residential waste generators must provide pre-treatment and appropriate odor control. Odor control may be required elsewhere at BSU's discretion.
- 7.11.21.15.2. Odor control units shall be biofiltration systems and shall be sized for the design flow and anticipated odor control requirements.

7.11.21.16. Access Hatches and Guides (BSU Standard Detail PS-1)

- 7.11.21.16.1. The pump manufacturer, to insure sole source responsibility, shall supply access hatches and guides.
- 7.11.21.16.2. The frame shall be ¼" thick extruded aluminum with an integral anchor flange, door seat on all 4 sides, and mill finish.
- 7.11.21.16.3. The door leaf shall be ¼" thick aluminum diamond plate reinforced to withstand a 300 psf live load.
- 7.11.21.16.4. The floor access door shall be equipped with a flush drop handle that does not protrude above the cover, and a stainless steel hold open arm with a red vinyl grip that automatically locks the cover in the 90° open position.

- 7.11.21.16.5. The door shall have stainless steel hinges with stainless steel tamper resistant bolts and locknuts. A staple for a padlock shall be supplied for security.
- 7.11.21.16.6. The door shall be 32"x48" for 6' diameter wet wells and 34"x48" for 8' diameter wet wells.
- 7.11.21.16.7. All stainless steel components shall be Type 316. An adhesive backed vinyl material that protects the product during shipping and installation shall cover the entire top of the frame and cover.
- 7.11.21.16.8. The doors shall have a BSU approved method to eliminate vibration of the doors when the pumps activate.
- 7.11.21.16.9. Installation shall be in accordance with the manufacturer's attached instructions.
- 7.11.21.16.10. The door shall be manufactured and assembled in the United States. The manufacturer shall guarantee the door against defects in materials and workmanship for a period of 10 years.
- 7.11.21.16.11. All hatches shall be furnished with a safety grate/net.

7.11.21.17. Pump Station Water Supply System

- 7.11.21.17.1. All sewage pump stations shall be provided with a station water supply system with adequate capacity and pressure for wash down utilization.
- 7.11.21.17.2. The pump station water supply shall be completely separated from the potable supply by use of a reduced pressure type backflow preventer or other approved protective system.
- 7.11.21.17.3. The backflow preventer shall be aligned so that the test cocks can be easily accessed for testing and maintenance.
- 7.11.21.17.4. Hose bibb(s) and hose(s) shall be provided at convenient locations to facilitate maintenance with special large capacity units installed for wet well wash down.

7.11.21.17.5. Potable water with a meter and RPZ backflow preventer shall be required and provided prior to any scheduled pump station start-up.

7.11.21.17.5.1. The location of the meter for the pump station shall be determined in the field during construction, and the location shall be represented accurately on the as-built record drawings.

7.11.21.17.6. Master pump stations require a 2" water service and 2" gate valve with appropriate backflow prevention; all other stations require a 1" water service with appropriate backflow prevention.

7.11.21.17.7. A 110 V solenoid shall be provided at all pump stations for purposes of irrigation (see pump station Standard Detail). BSU will wire the solenoid.

7.11.21.18. Pump Station Flow Meters

7.11.21.18.1. Flow meters shall be required for all developments with private water and wastewater systems connected to the BSU sanitary sewer system.

7.11.21.19. Pump Station Fence and Gate

7.11.21.19.1. Fencing shall be provided for all proposed pump stations. All materials shall be new and conform to ASTM standards. Installation shall be in conformance with ASTM F 567.

7.11.21.19.1.1. Fabric shall be helically wound and woven to a specified height with 2" diamond mesh, core wire diameter of 6 AWG. The selvage of the fabric is to be twisted on the top and the bottom (no barbed wire).

7.11.21.19.1.2. Fencing shall be PVC coated conforming to ASTM F668 Class 2b, 7 mil thickness thermally fused, and shall be black in color.

7.11.21.19.1.3. Steel posts shall conform to ASTM F 1083, type I, schedule 40. They shall be hot-dip galvanized with a minimum average of 1.8 oz. per ft² of coated surface area. Post sizes:

- 7.11.21.19.1.3.1. End and corner posts: 2½" for 6' high fence; 3" for 8' high fence
- 7.11.21.19.1.3.2. Line (intermediate posts): 2" for 6' high fence; 2½" for 8' high fence
- 7.11.21.19.1.3.3. Rail and braces: 1⅝"
- 7.11.21.19.1.3.4. Fencing shall be PVC coated in accordance with ASTM F 1043, 10 to 15 mils thermally fused, and shall be black in color.

- 7.11.21.19.1.4. Post tops shall be malleable iron or aluminum alloy designed as weather-tight enclosure caps for tubular posts, 1 cap per each post, and shall be black in color.

- 7.11.21.19.1.5. Tension wire shall be metallic coated steel wire, 7 AWG, thermally fused vinyl (permafused), and shall be black in color.

- 7.11.21.19.1.6. Tension bars (stretcher) shall be 1 piece lengths equal to 2" less than the full height of the fabric. They shall have a cross-sectional area of 3/16" x 3/4". Bars are to be provided where chain link fabric meets terminal posts.

- 7.11.21.19.1.7. Brace and tension bands shall be pressed steel.

- 7.11.21.19.1.8. Truss rods shall be steel rods with a minimum diameter of 5/16".

- 7.11.21.19.1.9. Brace ends shall be formed steel, malleable or cast iron for the connection of the rail and brace to terminal posts.

- 7.11.21.19.1.10. Wire ties shall be 9 AWG galvanized steel wire for attachment of the fabric to the line posts. Wire ties shall be double wrap 13 AWG for rails and braces. Hog ring ties shall be 12½ AWG for attachment of the fabric to the tension wire.

- 7.11.21.19.1.11. Nuts and bolts shall be stainless steel but not vinyl coated.

- 7.11.21.19.1.12. All fence accessories shall be ASTM F 626, stainless steel and finished to match the framing unless specifically stated otherwise.

- 7.11.21.19.1.13. Gates shall be a minimum of two (2) 8' wide swinging gates. Gate frames shall be swing gates conforming to ASTM F 900 using galvanized steel tubular members, 2" outside diameter, weighing 2.6 lbs. per foot. The gates shall have fusion or stainless steel welded connections forming a right, one-piece unit. The frames shall be vinyl coated thermally fused with 10 to 15 mils of PVC per ASTM 1043.
- 7.11.21.19.1.14. For gates 8' high, provide at a minimum 1½" square additional horizontal and vertical interior members to ensure proper strength.
- 7.11.21.19.1.15. Gate fence fabric shall consist of the same material as the above referenced fence material. Install the fabric with hook bolts and tension bars at all 4 sides, attached to the gate frame at more than 15" on center.
- 7.11.21.19.1.16. Hinges shall be structurally capable of supporting the gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit the gate to swing 180° outward as shown on the plans.
- 7.11.21.19.1.17. Gate latches shall be the forked type capable of retaining the gate in the closed position, and have provisions for a padlock. The latch shall permit operation from either side of the gate.
- 7.11.21.19.1.18. Provide a keeper for each gate leaf over 5' wide. The gate keeper shall consist of a mechanical device for securing the free end of the gate when in the full open position. Double gates shall contain a drop rod to hold the inactive leaf, and shall contain a gate stop pipe to engage the center drop rod.
- 7.11.21.19.1.19. Gate posts shall consist of the same material as the above referenced fence post material with the following additional requirements: 4" outside diameter and a weight of 9.11 lbs. per foot.
- 7.11.21.19.1.20. Chain and lock material shall consist of a stainless steel chain of an adequate length to secure the gate. A temporary lock to secure the pump station

during construction shall be supplied by the Contractor. The final lock is to be provided by BSU.

- 7.11.21.19.1.21. Fencing shall be installed in straight lines, in accordance with the manufacturer's recommendations and these specifications.
- 7.11.21.19.1.22. Post holes shall be at a minimum depth of 3' below finished grade with posts plumb and to a depth of 2'10". Holes for line posts shall be 9" in diameter and holes for gate, corner and pull posts shall be 16" in diameter. The remainder of the hole shall have concrete installed around the posts to a point of 2" above finished grade with the top surface to have a crown watershed finish. The concrete shall cure prior to installation of accessories. Post spacing shall not exceed 10' on centers and in true lines.
- 7.11.21.19.1.23. Chain link fabric shall be fastened to end posts with stretcher bars and clamps, and to line posts and top rails with wire or bands at approximately 14" and 24" on centers, respectively.
- 7.11.21.19.1.24. The top rail of the fence shall be located at the top of the fabric.
- 7.11.21.19.1.25. Leave approximately 2" between finished grade and the bottom of the selvage.
- 7.11.21.19.1.26. Gate posts shall be braced diagonally to adjacent line posts to ensure stability.
- 7.11.21.19.1.27. Gates shall be hung and adjusted so that the gates operate from the open or closed position in accordance with the manufacturer's recommendations.
- 7.11.21.19.1.28. A sign shall be affixed to the gate, clearly visible from the access driveway: "TOW AWAY ZONE UNAUTHORIZED VEHICLES & VESSELS WILL BE TOWED AT OWNER'S EXPENSE". (BSU Standard Detail PS-14)
 - 7.11.21.19.1.28.1. Signage is to be affixed utilizing stainless steel attachments and hardware.

7.11.22. Locator Tape and Ball Markers

- 7.11.22.1. Plastic locator tape, impregnated with metallic filings, shall be placed in the pipe trench at 12" above the top of pipe, 12" below finished grade, and labeled "water main" or "sewer main" as appropriate. The tape on the pipe must be covered with 12" or more of backfill material before the top tape is installed.
- 7.11.22.2. Ball markers shall be for the appropriate utility (i.e. water or wastewater).
- 7.11.22.3. Only approved ball markers will be permitted for use, and this will be strictly enforced.
- 7.11.22.4. Ball markers are to be placed in accordance with manufacturer specifications/recommendations (e.g. tethered, etc.).
- 7.11.22.5. Ball markers shall be placed at all fittings (including service saddles), at any change of direction along the pipeline, and at a maximum of 100' intervals along the pipeline between fittings. If there is not 100' of pipeline between mainline fittings, additional interim ball markers are not required.
- 7.11.22.6. The Contractor shall provide approximately 12" vertical separation between the fitting and the ball marker.
- 7.11.22.7. All locator tape and ball markers for potable water shall comply with the colors of Florida Administrative Code 62-555.
- 7.11.22.8. Locator tape and ball markers shall be installed per these specifications above the water/sanitary sewer pressure mains during backfill operations per standards outlined in the American Public Works Association (APWA) Uniform Color Code. Tape shall be tied to provide continuity. Any previously installed tape damaged during excavation shall be re-tied and repaired or replaced.
- 7.11.22.9. A ball marker check shall be performed on all projects, where applicable, by the Contractor and a BSU Inspector.
 - 7.11.22.9.1. After backfilling is complete, detection tests shall be conducted at a minimum of every 1,000' for tape. Tests shall be conducted at a minimum of every 100', at all changes in direction, and at all fittings for ball markers.

- 7.11.22.9.2. All fittings are to be staked and labeled. The stakes shall not be removed until cleared with the BSU Inspector.

7.11.23. Utility Markers for all Transmission Mains

- 7.11.23.1. The minimum height above ground shall be 4' with standard anchor.
- 7.11.23.2. They shall be blue for water mains, green for sanitary sewer force mains and purple for reuse water.
- 7.11.23.3. Labels are to be reflective and they shall be marked "CAUTION – WATER PIPELINE IN THIS AREA PLEASE CALL BSU (239-992-0711) BEFORE DIGGING" for water transmission lines, "CAUTION – FORCE MAIN PIPELINE IN THIS AREA PLEASE CALL BSU (239-992-0711) BEFORE DIGGING" for sanitary sewer force main transmission lines and "CAUTION – REUSE PIPELINE IN THIS AREA PLEASE CALL BSU (239-992-0711)" for reuse mains.
- 7.11.23.4. Markers are to be placed at intervals not to exceed 1,500' along transmission mains, or as directed by BSU.
- 7.11.23.5. Markers shall also be utilized for locating lines crossing all water bodies (natural or man-made), per FDEP specifications.
 - 7.11.23.5.1. Markers shall include the depth of cover of the line below the existing stream bed or river bed, as well as the line material type.
- 7.11.23.6. Transmission main designation shall be determined by BSU staff on a per project basis.

7.11.24. Corrosion Protection

- 7.11.24.1. Corrosion protection shall be required for underground ductile iron pipe and fittings.
 - 7.11.24.1.1. This shall be accomplished by the installation of a polyethylene encasement through the area of concern. Polyethylene encasement shall consist of a 4 mil cross laminate as approved by BSU.
 - 7.11.24.1.2. To determine the necessity for corrosion protection in suspect areas, the soil evaluation shall be those set forth in ANSI Standard A21.5.

- 7.11.24.1.3. Where other existing utilities are known to be cathodically protected, the ductile iron pipe crossing said utility shall be protected for a distance of 20' to each side. If ductile iron pipe is to be installed parallel to and within 10' of a cathodically protected pipe, then protection shall be provided for the entire length.
- 7.11.24.1.4. Steel pipe shall not be installed in severe corrosion areas.

7.11.25. Directional Drilling (BSU Standard Details CB-13 and CB-14)

- 7.11.25.1. All directional drilling shall require special approval by the BSU Engineering Department in writing.
- 7.11.25.2. Directional drilling shall be performed by an experienced Contractor acceptable to BSU.
- 7.11.25.3. Directional drilling with HDPE casing and carrier pipe shall be allowed for road or railway crossings with prior written approval from BSU and the Authority Having Jurisdiction (AHJ).
- 7.11.25.4. Directional drilling shall also be considered on a case by case basis to facilitate installation of utility mains in areas where restoration would be difficult, or in areas with limited space for construction equipment.
- 7.11.25.5. The boring logs (mapped at a minimum of 10' increments, and reflected as such on the as-built record drawings) shall be submitted to BSU for all directional drilling operations.
- 7.11.25.6. All directional drills shall have gate valves (water) or plug valves (sanitary sewer) on both ends as well as an ARV installed inside of the valve on both ends. The ARV's are not to be installed on the HDPE. Reference the Standard Details for Installation specifics.
- 7.11.25.7. Directionally drilled HDPE shall be hydrostatically tested separately from the remainder of the pressurized main.
- 7.11.25.8. Casing pipe for HDPE directional drilling shall have a minimum of 6" larger inside diameter (D.I.P.S.) than the outside diameter (D.I.P.S.) of the HDPE carrier pipe.
- 7.11.25.9. Casings for HDPE directional drilling are only required as directed by BSU.

- 7.11.25.10. Casing pipe end seals shall be one-piece, seamless neoprene boots with stainless steel (T-304) bands.
- 7.11.25.11. Ends of casings shall be sealed utilizing expandable foam insulation.
- 7.11.25.12. Casing spacers are not required for directional drilling.

7.11.26. Jack and Bore (BSU Standard Details CB-10 and CB-13)

- 7.11.26.1. The provisions of this section shall represent the minimum standards for the installation of casing pipe by the jacking and boring method for water and sanitary sewer pressure mains.
 - 7.11.26.1.1. Water and sanitary sewer pressure mains to be placed under Lee County Department of Transportation (LeeDOT), State of Florida Department of Transportation (FDOT), and/or railroad right-of-ways shall be installed in a casing to be jacked and bored under the vehicular travel way, as determined by BSU, or railway.
 - 7.11.26.1.2. The steel casing and jacking procedures shall conform to the requirements of FDOT as outlined in the "Utility Accommodation Guide Procedure 616 400" and any supplements thereto.
 - 7.11.26.1.3. All work and materials shall be subject to inspection by LeeDOT, FDOT or affected railroads.
 - 7.11.26.1.4. The Owner's property and surface conditions shall be restored to the original condition in keeping with the Owner's Standards and Specifications.
 - 7.11.26.1.5. Specific crossing requirements shall be obtained in advance from the Authority Having Jurisdiction (AHJ).
 - 7.11.26.1.6. It shall be the responsibility of the Contractor to submit the necessary permit documents and data to the appropriate authority and receive approval thereof.
 - 7.11.26.1.7. The Contractor shall maintain traffic on the roadway and shall keep all workmen and equipment clear of the vehicular travel way, as determined by BSU, during the work. All safety regulations of the Department shall be complied with.

7.11.26.2. Casing Pipe (applies to any non-directionally drilled mains)

- 7.11.26.2.1. Casing pipe shall be new prime steel pipe conforming to the requirements of ASTM A139.
- 7.11.26.2.2. The minimum casing pipe size and wall thickness shall be as shown in the following table, for the carrier pipe size indicated. For sizes not included, or for special design considerations, approval shall be obtained in writing from BSU.

The following table shows the requirements for steel casings:

<u>Carrier Pipe Nominal Size</u>	<u>Casing Pipe Outside Diameter</u>	<u>Casing Pipe Wall Thickness</u>
4"	14"	0.250"
6"	16"	0.250"
8"	18"	0.250"
10"	20"	0.250"
12"	24"	0.312"
14"	28"	0.312"
16"	30"	0.312"
18"	34"	0.375"
20"	36"	0.375"
24"	42"	0.500"

- 7.11.26.2.3. All casing spacers shall be made of 304 stainless steel with full 2" wide runners.
- 7.11.26.2.4. All casing spacers are to be ordered and installed in the "Centered & Restrained" position.
- 7.11.26.2.5. All casing spacers larger than 24" shall be factory designed, taking in consideration the weight of the carrier pipe filled with water.
- 7.11.26.2.6. All casing spacers shall have a minimum total design compression strength of 18,000 psi.
- 7.11.26.2.7. Spacing requirements shall be per the manufacturer's recommendations.
- 7.11.26.2.8. Wooden skids and polyethylene runners are unacceptable.

- 7.11.26.2.9. All calculations and drawings shall be submitted to BSU for review and approval.
- 7.11.26.2.10. Casing pipe end seals shall be one-piece, seamless neoprene boots with stainless steel (T-304) bands.
- 7.11.26.2.11. Ends of casings shall be sealed utilizing expandable foam insulation.
- 7.11.26.2.12. Casing pipes crossing under County roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum of 36" depth of cover between the top of the casing pipe and the surface of the roadway.
- 7.11.26.2.13. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of Lee County, the Contractor shall comply with the regulations of the Authority Having Jurisdiction (AHJ) in regard to design, specifications and construction.
- 7.11.26.2.14. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide".
- 7.11.26.2.15. Railroad casing installations shall be as specified in The American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapter 1 (Roadway and Ballast), Part 5 (Pipelines), Section 5.3 (Specifications for Pipelines Conveying Non Flammable Substances).
- 7.11.26.2.16. The jacking and boring operations shall be done simultaneously, with continuous installation until the casing pipe is in the final position.
 - 7.11.26.2.16.1. The correct alignment and grade shall be carefully maintained.
 - 7.11.26.2.16.2. Add on sections of casing pipe shall be full ring welded to the preceding length, developing water tight total pipe strength joints.
 - 7.11.26.2.16.3. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities.

7.11.26.2.16.4. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the casing pipe to preclude formation of voids outside of the pipe shell.

7.11.26.2.16.5. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion, if not in the hole, shall be replaced; however, if inserted, the encasement pipe shall be abandoned in place, suitably plugged, and an alternate installation made, as directed by the Authority Having Jurisdiction (AHJ) over the crossing and BSU.

7.11.26.2.16.6. Required jacking or boring pits or shafts shall be excavated and maintained to the minimum dimension. Said excavation shall be adequately barricaded, sheeted, braced and dewatered.

7.11.26.2.17. All main line casings under vehicular travel way, as determined by BSU, shall extend 5' past the edge of the vehicular travel way and/ or back of curb.

7.11.26.3. Carrier Pipe

7.11.26.3.1. Pressure main carrier pipes to be installed within the specified steel casings shall be restrained DR18 PVC for C900 Pipe. 14" and larger diameter pipe shall be restrained C905 DR25 PVC Pipe. Pipe and fittings shall comply with the applicable provisions of these Standards.

7.11.26.3.2. Casing spacers shall provide support of the carrier pipe within the casing. The pipe shall be restrained with casing spacers attached prior to pushing the carrier pipe through casing. One (1) spacer shall be placed within 2' from each end of the casing. One (1) spacer shall be placed on the spigot end of each segment of pipe at the line marking the limit of insert into the bell of the joint so that the spacer pushes the joint and relieves compression within the joint.

Subsequent spacers shall be placed at 6' intervals, or spacers shall be placed in accordance with the manufacturer's specification, if the distance apart is less than the above specified spacing. Following placement of the carrier pipe within the steel casing, end seals are to be installed at the casing ends.

7.11.27. Concrete and Flowable Fill

- 7.11.27.1. All concrete shall have a minimum compressive strength of 3,000 psi unless otherwise noted.
- 7.11.27.2. Flowable fill shall comply with FDOT Specifications Section 121.
- 7.11.27.3. Pipes and other appurtenances to be encased or backfilled with flowable fill shall be temporarily secured in place to prevent displacement of such during its placement.
- 7.11.27.4. A delivery ticket shall be furnished to BSU for each load of flowable fill delivered to the worksite. Information contained on the delivery ticket(s) shall be as listed in FDOT Specifications Section 121.
- 7.11.27.5. A sample may be required to be collected and tested, at the discretion of BSU.

7.11.28. Protective Concrete Slab and Concrete/Flowable Fill Encasement

- 7.11.28.1. Concrete encasement or encasement with flowable fill shall be constructed in accordance with the Specifications for the following instances:
 - 7.11.28.1.1. The water line crosses under, or at a depth which provides less than 12" separation from sanitary sewer lines. The encasement shall extend so that both joints shall be equidistant and as far from the conflict as possible. Either pipe may be encased.
 - 7.11.28.1.2. The Engineer of Record or BSU has ordered the line encased with concrete/flowable fill.
- 7.11.28.2. An electric or gas line crossing a BSU line shall have a minimum 18" vertical separation and 5' (minor feed, i.e. BSU service lateral) or 10' (major feed, i.e. BSU main line infrastructure and fire hydrants) horizontal separation. Specific approval is required from BSU in writing for reduced separation from any electric or

gas line. If approved by BSU, a concrete/flowable fill encasement shall be required. (BSU Standard Detail W-15)

- 7.11.28.3. The points of beginning and ending of the pipe encasement shall not be more than 6" from a pipe joint in order to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.
- 7.11.28.4. Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed utility against excessive loads, or when insufficient cover exists.
- 7.11.28.5. Dimensions of the concrete/flowable fill encasement shall be per the Concrete Arch and Cradle details as shown on BSU Standard Detail CB-3. Dimensions of a concrete slab shall be 4" thick and 3' wide, centered over the main. A 6" sand cushion shall be installed between the slab and the main.

8. CONSTRUCTION / TESTING SPECIFICATIONS

- 8.1. All connections to existing mains shall be made by the Contractor under the direction and supervision of BSU, including but not limited to fire hydrants and fire service lines. Valves separating the mains being installed from existing mains shall be operated by or under the direction of BSU. The Developer shall pay for the cost of the work in making the connections to existing systems and for extending service to adjacent properties.
- 8.2. All water main connections shall be subject to Florida Department of Health (FDOH) sampling and testing
- 8.3. All work on existing mains (tap, jack and bore, directional drill, etc.) shall be conducted during BSU working hours (7:00 A.M. to 4:00 P.M., Monday through Friday). Any work performed outside of the stated hours must be approved by BSU in writing prior to commencement of said work, with provisions made by the Contractor to have a BSU representative on site during construction.
- 8.4. Work on BSU lines or any other utilities shall not result in BSU's customers being without water and/or wastewater service for more than 4 hours. BSU shall be notified 48 hours in advance so that customer(s) can be notified.
- 8.5. All traffic control signs will be set up in accordance with state or county Department of Transportation Regulations, depending on which one has jurisdiction of the right of way being worked in.

8.6. Material Check

- 8.6.1. All materials shall conform to these specifications and shall be subjected to visual inspection by BSU at the time of delivery, just before they are utilized. Visual inspection is also required at any time at the discretion of BSU. Material checks must be scheduled with BSU with 48 hours' notice.
 - 8.6.1.1. Pipe joints or fittings that do not conform to these specifications will be rejected and must be removed from the site immediately by the Contractor.
 - 8.6.1.2. The entire product of any plant may be rejected when, in the opinion of BSU, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.
 - 8.6.1.3. At the discretion of BSU, the Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied to the BSU service area have been inspected at the plant, and that they meet the requirements of these specifications.
 - 8.6.1.4. Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.
 - 8.6.1.5. Materials that are defective or do not conform to these specifications will be rejected and must be removed from the site immediately by the Contractor. Materials are to be removed and replaced with acceptable materials at the Contractor's expense. At the discretion of BSU, the rejected material(s) may be permanently marked as to aide in the prevention of the aforementioned rejected material(s) from reappearing on alternate job sites within BSU's franchise.

8.7. Water for Construction (BSU Standard Detail W-1)

- 8.7.1. The Contractor shall install a temporary assembly including an in-line meter for metering water used during construction.
- 8.7.2. Construction meters and backflow preventers are 2", and shall be furnished by BSU at a cost to be paid by the Contractor per BSU Tariff rates. The Contractor is responsible for supplying meters and backflows larger than 2", if required and approved in writing by BSU.
 - 8.7.2.1. Backflows supplied by the Contractor shall be tested and certified before use and proof thereof shall be supplied to BSU for review prior to releasing the meter.

- 8.7.3. The jumper assembly shall be located where a permanent connection is proposed.
- 8.7.4. The Contractor shall also pay for water used during construction at BSU Tariff rates. The Contractor shall contact the Engineering Department for details.
- 8.7.5. A construction meter may be utilized under the following circumstances:
 - 8.7.5.1. Potable water exists, a water main extension is required (not including fire main extensions), and water is needed for construction (the sanitary sewer connection will not be made until construction and turnover is complete).
 - 8.7.5.2. The potable water main has been constructed and bacteriological testing has passed (no connection to sanitary sewer).
 - 8.7.5.3. In extensive projects (i.e. construction that may take years to complete), at BSU's discretion, permanent meters may be placed, but classified as temporary. Certain limitations may be imposed, including but not limited to, no water being introduced into the sanitary sewer system. A letter will be required from Developer / Owner and Contractor stating no water shall be introduced into the sanitary sewer system. Temporary meters are subject to an Agreement between the Developer and BSU.
- 8.7.6. The tap for the construction meter will be made by the Contractor hired by the Developer / Owner with the following conditions:
 - 8.7.6.1. The tap will be the size required for the permanent meter (whether larger or smaller).
 - 8.7.6.2. The tap will be done at the location of the permanent meter, unless otherwise approved by BSU in writing.
 - 8.7.6.3. The BSU Inspector, who will also supply the meter to the Contractor, must witness the tap.
 - 8.7.6.4. A backflow prevention device is required, and the tap shall not be allowed to be performed until the backflow preventer and assembly has been approved by the BSU Inspector for compliance with the Specifications.
 - 8.7.6.5. All construction meters are to be set above ground. The backflow preventer shall be installed a minimum of 18" above the ground.

- 8.7.6.6. No construction water is to be introduced into the sanitary sewer system, whether or not the sanitary sewer is complete.

8.8. Existing Conditions / Improvements

- 8.8.1. The Contractor shall maintain in operating condition all active utilities, sewers, gutters and other drains encountered in the utility installation.
- 8.8.2. The Contractor shall repair to the satisfaction of the Owner, any surface or sub surface improvement damaged during the course of the work (unless such improvement is shown to be abandoned or removed), whether or not such improvement is shown on the drawings.

8.9. Abandonment

- 8.9.1. Grout utilized for abandonment is to be fly ash or a cement slurry.
- 8.9.2. Water mains (potable, raw, reuse, irrigation) designated for abandonment are to be filled with grout.
- 8.9.3. Sanitary sewer lines (gravity mains and laterals, force mains) designated for abandonment are to be flushed clean to remove any wastewater and solids and subsequently filled with grout. The Contractor is responsible for securing and providing flushing water, collection of flush water/wastewater, and disposal. All cleaning shall be in compliance with all local and FDEP requirements.
- 8.9.4. Sanitary sewer manholes designated for abandonment shall have the cone section removed, and cleaned in a similar fashion to the sanitary sewer lines. The remaining manhole structure is to be filled with grout or flowable fill. The excavation is to then be backfilled with suitable fill per these Specifications.
- 8.9.5. Appurtenances (hydrants, valves, ARVs, etc.) designated for abandonment are to be removed to the main.
 - 8.9.5.1. If the main line is to remain active, all tees for abandoned appurtenances are to be removed and the active main is to be re-established with repair sleeves. If approved by BSU, the tee may be plugged.
 - 8.9.5.2. If approved by BSU, a valve can be abandoned in place by removing the valve box, pad, and operator, and left in the open position.

8.10. Excavation, Trenching, Backfilling, and Restoration (BSU Standard Detail CB-9)

8.10.1. The provisions set forth in this Section shall be applicable to all underground sanitary gravity sewer, sanitary sewer force mains, and water piping installations, regardless of location. Special design considerations shall require written approval from BSU.

8.10.2. Sheeting and Bracing

8.10.2.1. In order to prevent damage to property, injury to persons, erosion, cave in or excessive trench width, adequate sheeting and bracing shall be provided per the regulations of the U.S. Department of Labor Occupational Safety & Health Administration (OSHA) and/or as directed by the Engineer of Record.

8.10.2.2. The Contractor shall comply with local regulations, or in the absence thereof, with the "Manual of Accident Prevention in Construction" of The Associated General Contractors of America (AGC). This work shall be performed in accordance with accepted standard practice when the design consideration warrants such due to adverse soil condition, proximity of existing utilities, maintenance, and protection of traffic.

8.10.2.3. Sheeting shall be removed when the trench has been backfilled to at least $\frac{1}{2}$ its depth or when removal would not endanger the construction of adjacent structures.

8.10.2.4. When required to eliminate excessive trench width or other damage, the shoring or bracing shall be left in place and the top shall be cut off at an elevation $2\frac{1}{2}'$ below finished grade, unless otherwise directed.

8.10.2.5. Wood sheeting to be left in place shall be pressure treated with preservative in accordance with the AWWA Manual of Recommended Practice. The wood preservative used shall conform to the requirements of FDOT's Standard Specifications for Road and Bridge Construction and tested in accordance with AASHTO T60.

8.10.2.6. Steel sheeting to be left in place shall meet the requirements of ASTM Designation A328.

8.10.2.7. All sheeting and bracing shall be completed with strict adherence to OSHA Regulations.

- 8.10.2.8. All sheeting and bracing that is left in place shall be clearly designated on the as-built record drawings.

8.10.3. Protection of Pipe Laid in Fill Areas

- 8.10.3.1. The underground utilities specified shall not be laid in areas of fill prior to the actual performance of the grading operation, unless the depth of the cover over such utilities below the existing ground surface is at least 30" for pipe 10" and smaller, and 36" for all pipe larger than 10".
- 8.10.3.2. The depth of cover requirement may be reduced provided concrete cradling, encasement or other manner satisfactory to BSU protects the pipe.
- 8.10.3.3. Lines in excess of 5' deep to the bottom of the pipe, upon completion of fill operation, shall not be permitted and shall be re-laid prior to final acceptance by BSU.

8.10.4. Trench Dimensions

- 8.10.4.1. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8" for an un-sheeted trench, or 12" for a sheeted trench.
- 8.10.4.2. The maximum width of the trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2', unless otherwise shown on the drawing details or approved by BSU.
- 8.10.4.3. Trench walls shall be maintained vertical from the bottom of the trench to a line measured 1' above the top of the pipe. From 1' above the top of the pipe to the surface the trench walls shall be approximately vertical, or as specified to conform to OSHA Regulations.

8.10.5. Trench Grade

- 8.10.5.1. Final grading of trench bottoms shall be done with hand tools. Machine excavation shall be done only to such a depth that the soil bearing for pipes will not be disturbed. Grade the bottom of trenches evenly to ensure a uniform bearing surface for all pipes, cutting holes as necessary for joints and joint making.
- 8.10.5.2. As an alternate method, excavate the trenches to at least 4" below the required bottom levels and refill to the proper grade

with firmly compacted sand or gravel. Nothing larger than #57 stone shall be in contact with the pipe.

8.10.5.3. In rock, cemented gravel, old masonry or other hard non-cushioning material, excavate to at least 4" below the pipe at all points and then refill the trench to grade with firmly compacted sand or gravel. Nothing larger than #57 stone shall be in contact with the pipe.

8.10.5.4. In fill containing refuse, organic matter or similar substances, remove such material to a depth of at least 6" below the pipe at all points and then refill the trench to grade with firmly compacted sand or gravel. Nothing larger than #57 stone shall be in contact with the pipe.

8.10.5.5. Soil unsuitable for a proper foundation encountered at or below the trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach a suitable foundation material, unless special design considerations receive prior written approval from BSU.

8.10.6. Excavated Material

8.10.6.1. Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available.

8.10.6.2. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used, and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.

8.10.7. Material Disposal

8.10.7.1. Excess, unsuitable, or cleared and grubbed material resulting from utility installation shall be immediately removed from the work site and disposed of at a location secured by the Contractor.

8.10.8. Borrow

8.10.8.1. Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the Contractor and approved by BSU. Copies of all test results shall be submitted to BSU.

8.10.9. Rock Excavation

- 8.10.9.1. Rock excavation shall be defined as excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jackhammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

8.10.10. Dewatering

- 8.10.10.1. Water shall not be allowed in the trench while the pipes are being laid and/or tested.
- 8.10.10.2. The Contractor shall not create more trenches than the available pumping facilities are able to dewater (to the satisfaction of the Engineer of Record).
- 8.10.10.3. If subsurface water is encountered, the Contractor shall use approved means to dewater the excavation. A well point system or other approved equipment shall be installed if necessary to maintain the excavation in a dry condition for the placing of concrete and setting pipe lines.
- 8.10.10.4. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working.
- 8.10.10.5. In no case shall the pipelines being installed be used as drains for such water and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers, and not improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructions into the pipelines. If on completion of the work any such material has entered the pipelines, they shall be cleaned so that the entire system will be left clean and unobstructed.
- 8.10.10.6. Laying pipe underwater is not permitted without special written permission from BSU (prior to installing the pipe) under the following conditions:
 - 8.10.10.6.1. The following subsurface conditions shall be present before the laying of sanitary gravity sewer pipe underwater can be considered:
 - 8.10.10.6.1.1. This procedure can be used where the dewatering discharge exceeds the limit allowed by the South

Florida Water Management District (SFWMD), usually greater than 10 mgd.

- 8.10.10.6.1.2. This procedure can be used where the pumping of water from the trench causes the crushed stone bedding under the pipe to flow toward the pump suction line causing settlement of the pipe.
- 8.10.10.6.1.3. The laying of sanitary gravity sewer pipe underwater shall be specifically approved in writing by BSU for a particular project prior to construction. Approval for 1 project or a portion of a particular project shall not be misconstrued as a blanket approval for this procedure on any other projects or any portions of other projects.
- 8.10.10.6.2. The following methodology may be used for the installation of sanitary gravity sewer pipe underwater, with prior written approval by BSU. Other methodologies must be submitted to BSU for review.
 - 8.10.10.6.2.1. The Contractor shall partially dewater the pipe trench to a point 1' to 3' over the top of the pipe elevation.
 - 8.10.10.6.2.2. The Contractor shall set the laser alignment using the overhead method and use the overhead laser target supplied by the laser manufacturer. The overhead method for laser setup shall be as follows:
 - 8.10.10.6.2.2.1. The laser shall be set on a stand located behind the downstream manhole.
 - 8.10.10.6.2.2.2. The laser shall be setup so that the beam is 1' to 2' above the ground elevation.
 - 8.10.10.6.2.2.3. The laser beam shall be directed toward the upstream manhole stake.
 - 8.10.10.6.2.2.4. An overhead target with a built in level bubble shall be used to keep the pipe on line and grade below the laser beam.
 - 8.10.10.6.2.2.5. The overhead target shall be designed and constructed by the laser manufacturer, and

shall be used in conjunction with the particular laser model specified by the laser manufacturer.

- 8.10.10.6.2.3. The Contractor shall pump clean water from the trench into the downstream manhole.
- 8.10.10.6.2.4. The Contractor shall use a 3" to 4" pump to keep the water flowing through the pipe during the installation.
- 8.10.10.6.2.5. The Contractor shall excavate the trench for the pipe by undercutting a minimum of 6" below the pipe invert.
- 8.10.10.6.2.6. The Contractor shall, before installing the pipe, install tape on the pipe "home line" to allow the pipe layer to feel when the joint is properly pushed together.
- 8.10.10.6.2.7. The Contractor shall install the pipe and place the overhead target at the bell end. The pipe layer shall hold the pipe to line and grade. The Contractor shall place and grade crushed stone around pipe with backhoe bucket, for the entire pipe length. Crushed stone shall be sliced with a shovel to fill under the pipe while the pipe layer holds the pipe in place. The slicing action with the shovel shall insure proper distribution of the crushed stone under the pipe. Each backhoe bucket full of crushed stone shall be sliced under pipe before the next bucket is distributed over the pipe. Crushed stone shall be placed in this manner until the stone is a minimum of 1' over the top of the pipe. Nothing larger than #57 stone shall be in contact with the pipe.
- 8.10.10.6.2.8. The Contractor shall backfill the remainder of the trench with a backhoe, taking care to keep large rocks out of the backfill until the trench is backfilled to at least 3' above the top of the pipe.
- 8.10.10.6.2.9. The Contractor shall perform the normal testing and the videotaping of pipe construction.

8.10.10.6.3. The following additional conditions apply to pipe installed underwater:

8.10.10.6.3.1. The Engineer of Record shall certify that the methodology detailed above was used for pipe construction for all underwater installation of sanitary gravity sewer pipe.

8.10.10.6.3.2. A representative of the Engineer of Record shall observe all underwater installation of sanitary gravity sewer pipe.

8.10.10.6.3.3. The Engineer of Record shall notify BSU when the underwater installation of sanitary gravity sewer pipe will commence.

8.10.10.6.3.4. As-built record drawings and associated CAD file shall specifically identify the portion of underwater sanitary gravity sewer pipe installation.

8.10.10.6.3.5. A warranty for a total of 2 years shall be provided for the portion of underwater sanitary gravity sewer pipe installation.

8.10.10.6.3.6. Normal testing in accordance with BSU specifications shall be performed for the portion of underwater sanitary gravity sewer pipe installation as well as all other sanitary gravity sewer pipe installation.

8.10.10.7. The Contractor shall be responsible for all applicable state and local regulations regarding offsite discharge of water and turbidity control per the Engineer of Record's instructions.

8.10.11. Obstructions

8.10.11.1. It shall be the Contractor's responsibility to become acquainted with all existing conditions, and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts.

8.10.11.2. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the facility to be disturbed.

8.10.11.3. Facilities or structures damaged during the course of the work shall be repaired and/or replaced immediately, conforming to

current standard practices of the industry, or according to the direction of the Owner of such facility, at the Contractor's expense.

- 8.10.11.4. All water pipes, storm drains, sanitary sewer force mains, gas lines or other pipe, telephone lines, power cables, conduits, curbs, sidewalks, all house services and all other obstructions, whether or not shown, shall be temporarily removed from or supported across utility line excavations.
- 8.10.11.5. Rules and Regulations governing the respective utilities shall be observed in executing all work.
 - 8.10.11.5.1. Active utilities, if encountered, shall be protected in accordance with written instructions of the Engineer of Record.
 - 8.10.11.5.2. Inactive and/or abandoned utilities encountered in trenching operations shall be removed, plugged or capped.
 - 8.10.11.5.3. In absence of specific requirements, plug or cap such utility lines at least 5' from the utility line to be installed or as required by local regulations.
- 8.10.11.6. Underground sprinkler system piping encountered within the work area interfering with swale grading or other work requirements shall be capped-off and removed by the Contractor in such a manner as to not render the system unusable, if possible. Prior to sod placement, the system shall be repaired and/or replaced by the Contractor.
- 8.10.11.7. Existing materials in the work area are to remain the property of the affected property Owner(s) and if removed, shall be surrendered to the respective property Owner.
- 8.10.11.8. Where it is necessary to temporarily interrupt house services, the Contractor shall notify the house Owner or occupant before the interruption and again immediately before service is resumed. Before disconnecting any pipes or cables, the Contractor shall obtain permission from their Owner, or shall make suitable arrangements for their disconnection by their Owner. The Contractor shall be responsible for any damage to any such pipes, conduits or cables, and shall restore them to service promptly as soon as the work has progressed past the point involved.

- 8.10.11.9. Approximate locations of known water, sanitary, drainage, power, gas and telephone installations along the route of new pipelines or in the vicinity of new work are shown, but must be verified in the field by the Contractor. The Contractor shall uncover the aforementioned pipes, ducts, cables, etc., carefully, by hand, prior to installing new utility lines. Any discrepancies or differences found shall be brought to the attention of the Owner and the Engineer of Record in order to make any necessary changes that may be required to permit installation of new pipe.
- 8.10.11.10. Where fences, walls, or other man made obstructions exist illegally in the public right-of-way, the Owner shall have them removed upon adequate prior notice by the Contractor.

8.10.12. Tree Protection

- 8.10.12.1. Exercise care to protect the roots of trees to remain. Within the branch spread (canopy) of such trees, perform all trenching by hand. Open the trench only when the utility can be installed immediately. Prune injured roots cleanly and backfill as soon as possible. Perform all this work under the direction of the Engineer of Record.

8.10.13. Backfilling

- 8.10.13.1. Backfill material shall be clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or an approved combination thereof.
- 8.10.13.2. Backfilling shall be accomplished under 2 specified requirements: First Zone, from the trench grade to a point 12" above the top of the utility; and, Second Zone, from the top of the First Zone to the ground surface.
- 8.10.13.3. Where structures, encasements, or other below grade concrete work have been installed, backfilling shall not proceed until the concrete has cured to a point of sufficient strength to support the backfill load.

8.10.13.4. First Zone

- 8.10.13.4.1. Fine material shall be carefully placed and tamped around the lower half of the utility.

- 8.10.13.4.2. Backfilling shall be carefully continued in layers not exceeding 12" in thickness for the full trench width, until the fill is 12" above the top of the utility, using the best available material from the excavation, if approved. Each lift must be thoroughly compacted prior to succeeding lifts.
- 8.10.13.4.3. The material for these first layers of backfill shall be lowered to within 2' above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact.
- 8.10.13.4.4. The "First Zone" shall be thoroughly compacted and completed before the "Second Zone" is placed.
- 8.10.13.4.5. Unless otherwise specified, compaction shall equal 98% of the maximum density, as determined by AASHTO Specification T 180.
- 8.10.13.4.6. The "First Zone" backfill shall exclude stones, or rock fragments. The maximum gradation shall be $\frac{3}{4}$ ".

8.10.13.5. Second Zone

- 8.10.13.5.1. The remainder of the trench, above the "First Zone", shall be backfilled in layers not exceeding 12". Each lift must be thoroughly compacted prior to succeeding lifts.
- 8.10.13.5.2. The maximum dimension of a stone, rock, or pavement fragment shall be 4".
- 8.10.13.5.3. When trenches are cut in vehicular travel ways, as determined by BSU, compaction as determined by AASHTO Specification T 180 shall be equal to 98% of the maximum density, with compaction in other areas not less than 95% of the maximum density.

8.10.13.6. Compaction Methods

- 8.10.13.6.1. The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first 12" of backfilling over the pipe shall be compacted by hand operated tamping devices.

- 8.10.13.6.2. Hydraulic compaction shall not be allowed for the “First Zone” portion of the Backfilling and Compaction requirements included in this section.
- 8.10.13.6.3. The implementation of hydraulic compaction in the “Second Zone” shall first have written approval obtained from BSU via a Deviation Request.

8.10.13.7. Density Tests

- 8.10.13.7.1. A testing Laboratory approved by BSU shall perform density tests for a determination of the above specified compaction, at the expense of the Contractor.
- 8.10.13.7.2. Test locations shall be spaced not more than 100’ apart for each lift where the trench cut is continuous in roadways, paved or unpaved. At the discretion of BSU, BSU will dictate the test locations.
- 8.10.13.7.3. Tests shall also be performed where a trench crosses a roadway or future roadway.
- 8.10.13.7.4. If any test results are unsatisfactory, the Contractor shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be performed on each side of an unsatisfactory test, as directed, to determine the necessary extent of re-excavation and re-compaction.
- 8.10.13.7.5. If requested, copies of all density test results shall be furnished to BSU.

8.10.14. Restoration

- 8.10.14.1. Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired. The finished work shall be equal in all respects to the original and shall be approved by BSU.
- 8.10.14.2. Concrete restoration shall be to the first encountered joint past the limits of construction. If a painted driveway is disturbed, the entire driveway shall be repainted after the concrete has been restored so that there is no differentiation of color.
- 8.10.14.3. Pavement or roadway surfaces cut or damaged shall be replaced by the Contractor in equal or better condition than the original,

including stabilization, base course, surface course, curb and gutter or other appurtenances.

- 8.10.14.3.1. The Contractor shall obtain the necessary permits prior to any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.
- 8.10.14.3.2. Roadway restoration (within the Lee County Department of Transportation jurisdiction). Restoration shall be in accordance with the requirements set forth in the "Lee County Development Standards" and these Standards. The materials of construction and method of installation, along with the proposed restoration design for items not referred or specified herein, shall receive prior approval from the County. Where existing pavement is to be removed, the surfacing shall be mechanically saw-cut prior to trench excavation, leaving a uniform and straight edge parallel to the utility, with minimal disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
- 8.10.14.3.3. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for 10 days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to 15 days after application, the temporary surfacing shall be removed and the final roadway surface restoration shall be accomplished.
- 8.10.14.3.4. In advance of the final restoration, the temporary surfacing shall be removed and the existing pavement shall be mechanically saw-cut straight and clean, at a minimum of 12" outside of the ditch line. Following the above operation, the Contractor shall proceed immediately with the final pavement restoration in accordance with the requirements set forth by the Lee County Department of Transportation.
- 8.10.14.3.5. Roadway Restoration (outside the Lee County Department of Transportation jurisdiction). Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County shall conform to the

requirements of the Governmental Authority Having Jurisdiction (AHJ) (i.e. Florida Department of Transportation (FDOT), City of Bonita Springs, or Village of Estero). Work within the FDOT right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of FDOT.

- 8.10.14.3.6. All drainage should be restored to its original conditions unless directed by the appropriate Regulatory Agency.
- 8.10.14.4. During the course of construction, the Contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right of way, easement or site, and take full responsibility for the replacement or repair thereof.
- 8.10.14.5. The Contractor shall immediately repair any damage to private property created by encroachment thereon. Should the removal or trimming of valuable trees, shrubs, or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the County and/or local communities in which the work takes place. Said valuable vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is re-established.
- 8.10.14.6. Topsoil damaged in the course of work shall be replaced with at least a 4" layer of suitable material. Following construction completion, the work area along the route of the installation shall be finish graded to elevations compatible with the adjacent surface, with grassing or hand raking required within developed areas.

8.10.15. Cleanup

- 8.10.15.1. Work site cleanup and property restoration shall follow behind construction operation without delay. In order to facilitate an acceptable construction site, debris and waste materials shall be removed from the site immediately and the daily trenching length versus the length of pipe laying shall be coordinated to minimize the trench opening to be left overnight. Construction site maintenance, along with ongoing cleanup and final property restoration acceptance, shall be as directed by BSU.

8.10.16. Confined Space Entry

- 8.10.16.1. Entry into any BSU owned and maintained confined space (e.g. manholes, pump station wet wells, etc.) shall not be permitted without the approval of BSU.
- 8.10.16.2. BSU will not permit entry into any confined space unless all United States Department of Labor Occupational Safety & Health Administration (OSHA) practices and procedures for confined space entry are adhered to. This will be strictly enforced.

8.11. Flushing and Pressure Testing of Pipelines

8.11.1. Flushing Mains (BSU Standard Detail W-8)

- 8.11.1.1. Upon completion of the pressurized pipeline system, all valves shall be tested to ensure their full opening, the system shall be flushed out progressively to remove all sand and any other foreign matter by opening blow offs and building outlets, and before final acceptance of the work further tests shall be made from blow offs and outlets to ascertain that the lines are clear. A full-bore flush is required, and connection to accomplish such is not permitted until the day of the flush.
- 8.11.1.2. The Contractor is to schedule with the BSU Engineering Department 24 hours prior to flushing.
- 8.11.1.3. For all pressurized mains, the velocity of the flushing water shall be at least 3 fps.
 - 8.11.1.3.1. Pigs will be required where minimum velocity cannot be obtained, the pipeline diameter is greater than 12", or at the discretion of BSU.
 - 8.11.1.3.1.1. A swab-type pig is required for HDPE pipe; a 5-7 lbs./ft³ density poly-jacketed bullet style foam pig is required for all other pipe.
- 8.11.1.4. All mains or service lines 6" or larger shall be scheduled by the BSU Engineering Department (flushing times may vary when water restrictions are in force).
- 8.11.1.5. Flushing shall be terminated at the direction of BSU.
- 8.11.1.6. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

- 8.11.1.7. For water mains, the connection shall be separated immediately following a successful flush, the ends of the mains capped per these requirements, and a jumper assembly shall be installed within 24 hours of the flush.
- 8.11.1.8. For force mains, the connection shall be separated immediately following a success flush and the ends of the mains capped per these requirements. If applicable, the force main can remain connected until after a successful pump station start up.

8.11.2. Hydrostatic Testing

- 8.11.2.1. All new pressurized lines installed shall be tested for leakage.
 - 8.11.2.1.1. The test used will be Hydrostatic Testing for pressurized pipelines in accordance with AWWA C605-05. Tests performed shall be witnessed by the Engineer of Record and BSU representative(s).
- 8.11.2.2. The Engineer of Record shall provide the appropriate BSU testing form prior to the start of the testing process, with all values required to perform the test provided on the form.
 - 8.11.2.2.1. If the required form is not provided or filled out properly, the BSU Inspector shall cancel the test and it will be required to be rescheduled.
 - 8.11.2.2.2. The test shall not be rescheduled until the required re-inspection fee is paid (per BSU Tariff rates).
- 8.11.2.3. The Contractor shall perform hydrostatic testing of the system as set forth in the following, and shall conduct said tests in the presence of the Engineer of Record and representatives from BSU. Advance notice of 48 hours to BSU is required.
 - 8.11.2.3.1. Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from BSU in writing.
 - 8.11.2.3.2. Testing shall not proceed until restraining devices are installed.
 - 8.11.2.3.3. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter.

8.11.2.3.4. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section. Additional release cocks shall be provided if required.

8.11.2.3.5. Hydrostatic testing of pressurized mains shall be performed per the following specifications:

8.11.2.3.5.1. Unless otherwise approved in writing by BSU, testing shall be performed at a pressure of 150 psi for water mains and 100 psi for sanitary sewer force mains. The duration of the test shall not be less than 2 hours. Testing shall be in accordance with the applicable provisions as set forth in AWWA C605-05. The allowable quantity of makeup water shall be less than the number of gallons per hour determined by the following formula:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

- Q = Allowable quantity of makeup water (gallons per hour)
- L = Length of pipe section being tested (feet)
- D = Nominal diameter of the pipe (inches)
- P = Average test pressure during the hydrostatic test (psi)

8.11.2.3.6. Testing of tapping saddles shall be performed for 30 minutes at a pressure of 150 psi for water main tapping saddles and at a pressure of 100 psi for sanitary sewer force main tapping saddles (when allowed by BSU with written permission).

8.11.2.3.7. The testing procedure shall include the continued application of the specified pressure to the test system for the 2 hour period by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.

8.11.2.3.8. Should the test fail, the Contractor shall accomplish any necessary repairs and repeat the test until the results are within the established limits.

- 8.11.2.3.9. The Contractor shall furnish the necessary labor, water, pumps, and gauges at specified location(s) and all other items required to conduct the required pressurized system testing as well as to perform any necessary repairs.
- 8.11.2.3.10. Provisions for testing with a section of HDPE pipe within the test segment:
 - 8.11.2.3.10.1. The maximum test duration shall be 8 hours. Pressurizing the main for any test period longer than 8 hours could result in the failure of the product and voiding of the manufacturer's warranty.
- 8.11.2.4. Once the test has concluded, the required form shall be completed by the Engineer of Record.
 - 8.11.2.4.1. It is the responsibility of the Engineer of Record to oversee the test, know how to perform the required calculations, and provide the information on the form correctly, not the BSU Inspector.
 - 8.11.2.4.2. The completed form shall be initialed by the BSU Inspector after the Engineer of Record has performed all of the required calculations and supplied the information on the form.
 - 8.11.2.4.3. The BSU Inspector shall not initial the form until all of the information on the form has been properly filled out.
 - 8.11.2.4.4. A signed and sealed copy of the completed form shall be provided to BSU within 1 week after the successful test. A copy of the form shall also be required to be submitted with the turnover package.
 - 8.11.2.4.5. Chlorination and sampling of water mains shall not be allowed prior to BSU receiving a copy of the successful test.

8.11.3. Low-Pressure Air Testing

- 8.11.3.1. All new non-pressurized lines installed shall be tested for leakage.
 - 8.11.3.1.1. Low-Pressure Air Testing of non-pressurized sanitary sewer pipelines shall be in accordance with the criteria established in the "Recommended Practice for Low-

Pressure Air Testing of Installed Sewer Pipe” (UNI-B-6-98) by Uni-Bell PVC Pipe Association (www.uni-bell.org). Tests performed shall be witnessed by the Engineer of Record and BSU representative(s).

- 8.11.3.2. The Engineer of Record shall supply the test results using the “Air Test Data Sheet” form provided in the Appendix of UNI-B-6-98.
 - 8.11.3.2.1. It is the responsibility of the Engineer of Record to oversee the test, know how to perform the required calculations, and provide the information on the form correctly, not the BSU Inspector.
 - 8.11.3.2.2. The completed form shall be initialed by the BSU Inspector after the Engineer of Record has performed all of the required calculations and supplied the information on the form.
 - 8.11.3.2.3. The BSU Inspector shall not initial the form until all of the information on the form has been properly filled out.
 - 8.11.3.2.4. A signed and sealed copy of the completed form shall be provided to BSU within 1 week after the successful test. A copy of the form shall also be required to be submitted with the turnover package.

8.12. Sterilization of Water Distribution System

- 8.12.1. After the water distribution system has been flushed out and hydrostatically tested as specified, it shall be sterilized in accordance with the requirements of the Florida Department of Health (FDOH).
 - 8.12.1.1. NO WATER IS TO BE USED AFTER PASSING BACTERIOLOGICAL TEST RESULTS HAVE BEEN RECEIVED BY BSU; ANY CROSS-CONNECTIONS WILL REQUIRE RE-CHLORINATION.
 - 8.12.1.2. Introduce chlorine or a solution of calcium hypochlorite or sodium hypochlorite, filling the lines slowly and applying the sterilizing agent at a rate of 50 ppm of chlorine, as determined by residual chlorine tests at the ends of the lines. Open and close all valves and hydrants while the system is being chlorinated.
 - 8.12.1.3. After the sterilizing agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 5 ppm is indicated, repeat the sterilization process.

- 8.12.1.4. When tests show at least 5 ppm of residual chlorine, flush out the system until the chlorine level is that of the distribution system.
- 8.12.1.5. The Engineer of Record reserves the right to test the water again at any time prior to final acceptance of the work, and if found unsafe bacteriologically the Engineer of Record shall require the Contractor to re-chlorinate the system until the water is proven to be equivalent to that as supplied by the public system.
- 8.12.1.6. If samples fail, the line shall be re-flushed and resampled. If samples fail for a second time, re-chlorination is required. The process is to be repeated until consecutive passing samples have been obtained. Twenty four (24) hours is required between samples.
- 8.12.1.7. Re-chlorination of systems shall be done by adding 50 ppm of chlorine, not by flushing with BSU water.

8.13. Video Recording

- 8.13.1. Upon completion of construction, all new sanitary gravity sewer lines and all existing sanitary gravity sewer lines that have had work done to them (e.g. an added sanitary sewer service lateral or other work as determined by BSU) shall be cleaned (including manholes and laterals) and video recorded using BSU's "Dip-Depth Indicator" and mandrel.
 - 8.13.1.1. BSU requires video recording existing sanitary gravity sewer mains prior to any work being done on them as well.
- 8.13.2. Video recording is not to be performed until base rock has been installed and compaction has occurred.
- 8.13.3. All sanitary gravity sewer mains shall be video recorded at the Contractor's expense.
- 8.13.4. Videos will not be accepted that do not display conditions depicting infrastructure as it is to be turned over to BSU (i.e. inverts completed in manholes, linings/coatings in place in manholes).
- 8.13.5. Videos shall include circumferential views of the manholes for verification/documentation of the lining condition, invert, chimney, ring & cover, and any lateral connections in the manhole.
- 8.13.6. Video recordings of the televised mains shall be completed and supplied to BSU for review and approval a minimum of 2 weeks prior to the

anticipated turnover to BSU. Videos may also be supplied on a USB flash drive.

- 8.13.7. Videos are to be digital, .mpg format.
- 8.13.8. The Contractor shall use a color pan, tilt and zoom, camera or specifically designed and constructed for sanitary sewer inspection.
- 8.13.9. Videos are to display the following:
 - 8.13.9.1. Legible, discernible text.
 - 8.13.9.1.1. Date.
 - 8.13.9.1.2. Complete 7 digit BSU start and stop manhole numbers.
 - 8.13.9.1.3. The linear footage as the camera travels in the pipe.
 - 8.13.9.2. The contrast of the video must also be set so that all observations are able to be clearly identified, including reading the “Dip-Depth Indicator” (e.g. lighting for the camera shall provide a clear picture of the entire periphery of the existing sanitary sewer, the lights should not be so bright as to wash out any detail, etc.).
- 8.13.10. Mini-cam video recording of sanitary laterals is to be done as requested by BSU. Mini-cam videos are to record the address or lot number for location verification.
- 8.13.11. In the event that dips are found to exceed BSU tolerances, the mains shall be repaired at the Contractor’s expense.
- 8.13.12. Any sanitary gravity sewer line dips which exceed 1¼” shall not be accepted.
 - 8.13.12.1. Vibration of sanitary gravity sewer mains to bring dips into tolerance is not permitted without prior written approval from BSU via a Deviation Request.
 - 8.13.12.1.1. Deviation Requests for vibration are to include the following:
 - 8.13.12.1.1.1. Locations and depths of all dips included in the request.
 - 8.13.12.1.1.2. Preliminary video of the sanitary sewer utilizing BSU’s “Dip-Depth Indicator” for verification of said dips.
 - 8.13.12.1.1.3. If approved, the location and depth of all dips vibrated must be noted on the as-built record

drawings at turnover, as well as included in the as-built CAD file for inclusion into BSU's GIS.

- 8.13.12.1.1.4. A 5 year extended warranty on only the vibrated locations is required from both the Developer and Contractor.

8.13.13. Deflection Testing

- 8.13.13.1. Deflection tests shall be performed on all flexible pipe. The tests shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system.
- 8.13.13.2. No pipe shall exceed a deflection of 5 percent of the inside diameter. If deflection exceeds 5 percent, the pipe shall be excavated. Replacement or correction shall be accomplished in accordance with the requirements in the approved specifications.
- 8.13.13.3. The mandrel used for the deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, including the appendix, to which the pipe is manufactured. The tests shall be performed without mechanical pulling devices.

8.14. Pre-acceptance Walkthrough Inspection, Tie-ins, Final Inspection, and Warranty Inspection

- 8.14.1. At the times of the pre-acceptance walkthrough and final inspections of the work performed under the contract, the utilities to be dedicated to BSU shall be complete in every respect and in perfect operating condition.
 - 8.14.1.1. Infrastructure shall be clean, including the internal workings of the sanitary gravity sewer system.
 - 8.14.1.2. All surplus materials of every character resulting from the work shall be removed.
 - 8.14.1.3. Any defects discovered in the utilities subsequent to inspections shall be corrected prior to acceptance by BSU.
 - 8.14.1.4. All appurtenances will be inspected for fit and finish (e.g. valve pads/manhole collars shall be centered and rotated for aesthetics, vertical structures shall be plumb, etc.).

- 8.14.2. A pre-acceptance walkthrough inspection will be done with the Engineer of Record, Owner, Contractor, and BSU personnel present. Pre-acceptance walkthroughs shall not be held unless all parties are present.
- 8.14.2.1. The pre-acceptance walkthrough will not be scheduled until the BSU Inspector has verified that the site is ready.
 - 8.14.2.2. The Engineer of Record, Owner, or Contractor is responsible for coordinating the scheduling of the pre-acceptance walkthrough.
 - 8.14.2.3. The Owner shall be charged a re-inspection fee (per BSU Tariff rates) for any pre-acceptance walkthrough rescheduled due to all parties not being present.
 - 8.14.2.4. Subsequent walkthrough inspections required as a result of incomplete or unsatisfactory work shall require the Owner to pay a re-inspection fee (per BSU Tariff rates) for each additional walkthrough required until the project is satisfactorily completed.
 - 8.14.2.5. As a result of the pre-acceptance walkthrough, the Engineer of Record is responsible to create a punch list of items requiring attention prior to final acceptance or a letter stating no punch list items were generated. A copy of the signed and sealed punch list or no punch list items generated statement on the Engineer of Record's company letterhead is required to be submitted to the BSU Engineering Department within 48 hours of the pre-acceptance walkthrough.
 - 8.14.2.5.1. Verification of punch list completion shall be accomplished between the Engineer of Record, Contractor, and BSU Inspector. Upon completion of the punch list, the BSU Inspector will sign off on the punch list (initial/sign and date).

8.14.3. Tie-ins

- 8.14.3.1. Tie-ins will not be permitted until the all major outstanding issues with the turnover package have been addressed, and clearance has been received from FDOH/FDEP.
- 8.14.3.2. All punch list items generated from the pre-acceptance walkthrough should be complete and satisfactory prior to tie-ins even being scheduled with BSU.

- 8.14.3.3. Where service to Customers is to be or may be interrupted, adequate equipment with backup is to be provided onsite in order to ensure prompt restoration of service.
 - 8.14.3.4. Adequate temporary support is to be provided as necessary to ensure structural integrity of the affected infrastructure in the work zone.
 - 8.14.3.5. Best management practices are to be implemented to protect all portions of the project from damage.
 - 8.14.3.6. Protection from the elements is to be provided in the immediate work zone that may be exposed by cutting and patching. Excavations must also be maintained free from water.
 - 8.14.3.7. Materials are to be cut and removed to the extent shown or as required to complete the connection. Materials are to be removed with care as to not damage adjacent infrastructure. Non-salvageable materials are to be removed from the site.
- 8.14.4. A final inspection will be performed prior to acceptance of the project.
- 8.14.4.1. The only items that should be left to be inspected at final inspection are the tie-in locations and final restoration.
- 8.14.5. A warranty inspection is to be done 11 months after turnover, and corrections required to be made at that time shall be the responsibility of the person or company that provided the turnover warranty to BSU.

9. TURNOVER AND APPROVAL FOR SERVICE

- 9.1. The turnover package is to be submitted by the Engineer of Record. The contents of the turnover package are listed on the turnover requirements checklist, which can be found with the turnover forms.
- 9.2. Service shall not be provided until all items are complete, including all applicable information required by the GIS Implementation program. Please refer to the BSU web page for all of the GIS Implementation Documents. All infrastructure, as directed by BSU, shall be dedicated to BSU.
- 9.3. Per the Fire Control Districts within the BSU service area, combustible materials shall not be allowed onsite until fire protection is provided. This requires both water and wastewater facilities to be installed, tested, placed into service, and dedicated to BSU prior to fire service being considered for a project.

- 9.4. The Engineer of Record shall provide copies of all submittals, cut sheets and shop drawings for all projects to BSU. Submittal, cut sheet and/or shop drawing data are recommended to be sent by the Engineer of Record to BSU as approvals on the project are made, but shall be required to be included in the turnover documents submitted for project completion.
- 9.5. A keypad code must be provided upon installation of any gates hindering BSU access to infrastructure. Bar scanners, remote openers, or other devices utilized to open gates are not acceptable for BSU access. A BSU master-keyed lock may be permitted in instances as directed by BSU.
- 9.6. The legal description for the Exhibit in the Owner's Affidavit and Utilities Facility Warranty and Bill of Sale should encompass the project area where infrastructure was installed that will be turned over to BSU. It may be the same as the Grant of Utility Easement Exhibit; however, there are often times infrastructure is installed in existing utility easements or R.O.W. that needs accounted for. A simple way to look at it is the new utility easement areas plus the portions of the existing easement/R.O.W. areas in which infrastructure was installed that is to be dedicated to BSU.
- 9.7. FDEP Certifications will not be signed until the turnover process has been completed.

9.8. Record Drawings

- 9.8.1. One (1) complete set of signed and sealed record drawings and a .pdf copy of the same depicting as-built locations of all fittings, valves, hydrants, manholes, piping, pump stations and other appurtenances shall be sent to BSU before final approval.
 - 9.8.1.1. Infrastructure is to be depicted in constructed locations labeled accordingly with constructed attributes (e.g. lengths, elevations, etc.).
 - 9.8.1.2. Proposed/designed locations should be removed from the plans and proposed/designed elevations shall be shown with strikethrough values.
 - 9.8.1.3. The as-built record drawings should mimic the approved construction plans, with changes made accordingly. All sheets are to be included as listed in the Sheet Index on the Cover Page.
 - 9.8.1.4. The as-built survey is not acceptable to be submitted as a record drawing; however, it may be included.

- 9.8.1.5. Record drawings shall include field surveyed elevations on all manholes, pump stations, and other appurtenances necessary to verify completion of construction, and to provide for future connections or extensions.
- 9.8.1.6. Elevation data shall at a minimum include inverts, manhole rim elevations, pump stations including drop connection inverts, service lateral connections to manholes, connections to existing mains, and elevations of fittings used at vertical deflections.
- 9.8.1.7. Record drawings shall show final grades over the top of all gravity and pressurized mains, including landscape berm elevations.
- 9.8.1.8. Record Drawings shall graphically reflect boring logs for all directional drills with elevations mapped at a minimum of every 10'.
- 9.8.1.9. As-built elevations (i.e. inverts, rim elevations, top of pipe, finished grade, etc.) are to be graphically represented in the profile views; just labeling the as-built elevation is not adequate.

9.9. Warranty Video Recording

- 9.9.1. The Developer is required to pay BSU for warranty video recording in the 11th month after dedication for all sanitary gravity sewer mains. This fee is to be paid with the Application to Construct.
- 9.9.2. Sanitary gravity sewer lines shall be cleaned and videoed at the 11th month following acceptance by BSU to determine if warranty repairs are required. The video recording shall be conducted by BSU.
 - 9.9.2.1. If excessive cleaning due to construction debris is required (as determined by BSU), it will be the responsibility of the warrantor to do so. Subsequent to this inspection, dips outside of BSU's acceptable tolerance of 1¼" will not be accepted, unless otherwise approved by BSU in writing.
- 9.9.3. Grout repair of manholes, sanitary gravity sewer mains and/or laterals on new construction to be dedicated to BSU or following a subsequent warranty inspection is not permitted.

9.10. Contributory Assets

- 9.10.1. All potable water system and sanitary sewer system infrastructure installed that is to be dedicated to BSU for ownership and maintenance

(Contributory Assets) shall be listed on a Contractor's Certified List of Installed Materials & Cost and included with the turnover package.

- 9.10.1.1. For consistency, BSU's template is to be utilized. All of the Descriptions and Units of Measurement are pre-populated. Only Quantities and Unit Costs need to be populated. If there is not an option listed for an item that is to be dedicated to BSU, inform the BSU Engineering staff and an updated template will be provided.
- 9.10.2. Only physical assets that are to be dedicated to BSU are to be included (i.e. do not include grease interceptors, fire backflow preventers, etc.), and the cost of each asset should be the installed cost.
- 9.10.3. The List shall include an Item Description, Quantity, Unit, Unit Cost, and Total dollar amount for each item.
- 9.10.4. The potable water system group of assets and sanitary sewer system group assets shall be listed separately with Grand Totals for each.
- 9.10.5. The List shall include the project name, date, Contractor's and/or Engineer of Record's signature, and shall be notarized.
- 9.10.6. All linear assets (e.g. water mains, hydrant laterals, fire lines, sanitary sewer force mains, sanitary gravity sewer mains, sanitary sewer laterals, etc.) shall be listed as a "Linear Foot" (LF) cost, with the exception of water and irrigation service laterals.
 - 9.10.6.1. Fittings shall be included with the cost of the pipe and not itemized separately.
 - 9.10.6.2. All lines (including service laterals, main line casings, and pump station electrical services) shall be itemized by size, material, and size dimension ratio, where applicable.
 - 9.10.6.2.1. Directional drill casings shall be listed separately from the carrier pipe.
- 9.10.7. Water and irrigation service laterals shall be listed as "Each" (EA) for the unit cost, and furthered itemized as "long" or "short" in the Item Description to coincide with how they are described in BSU's Water Tariff.
 - 9.10.7.1. "Short" refers to being installed on the same side of the road as the water main.

- 9.10.7.2. “Long” refers to being installed on the opposite side of the road as the water main. Casings for water and irrigation services are assumed to be included with the cost of the long service lateral.
- 9.10.8. All point assets (e.g. ARV’s, blow offs, hydrants, valves, manholes, clean outs, pump stations, etc.) are to be listed as “Each” (EA) for the unit cost.
 - 9.10.8.1. Valves shall be itemized by size and type (gate, plug, etc.).
 - 9.10.8.2. 2” water service valves are to be itemized separately from the 2” water service lateral cost; however, corporation stops are to be included with the cost of the 1” water service laterals.
 - 9.10.8.3. Fire hydrants are not to be listed as an assembly (i.e. the valve(s), lateral, and hydrant are to be listed separately).
 - 9.10.8.4. ARV’s and blow offs are to be itemized by size.
 - 9.10.8.4.1. The main line size valve for blow offs is not to be included in the blow off assembly and should be itemized separately.
 - 9.10.8.5. Water meters greater than 2” shall be itemized by size.
 - 9.10.8.6. Sanitary sewer clean outs shall be itemized separately from the cost of the sanitary sewer service laterals.
 - 9.10.8.7. Pump stations are to be listed as the entire assembly (e.g. inclusive of the cost of the pumps and the access driveway); however, odor control units, generators, and electrical service line are to be itemized separately.

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