

**RESOLUTION NO. 16-106**

**A RESOLUTION OF THE CITY COMMISSION OF THE CITY OF EUSTIS, FLORIDA; ADOPTING THE CITY OF EUSTIS ENGINEERING & DESIGN STANDARDS, AS REFERENCED IN SECTION 118-20 OF THE LAND DEVELOPMENT REGULATIONS.**

**WHEREAS**, on December 15, 2016, the Eustis City Commission approved Ordinance No. 16-31, amendments to the Land Development Regulations (LDRs), which removed Appendix A Standard Transportation Construction Specifications, Appendix B Standard Stormwater Management Facility Construction Specifications, and Appendix C Standard Utility Construction Standards, and sections relating to the Cross Connection Manual from the LDRs and incorporated them by reference in Section 118-20 through 20.2 of the Land Development Regulations; and

**WHEREAS**, the City Commission finds it necessary to periodically revise and update regulations; and

**WHEREAS**, the City Commission finds the proposed revisions provide for improved engineering standards that are clarified, consistent, and communicate clear expectations for the construction of transportation, stormwater and utility facilities; and

**NOW, THEREFORE, BE IT RESOLVED BY THE EUSTIS CITY COMMISSION AS FOLLOWS:**

**SECTION 1.** The City of Eustis Engineering & Design Standards, a manual establishing rules and regulations for the installation, repair and maintenance of backflow prevention and cross connection control devices, roadway construction, stormwater management construction, and utility construction, is hereby adopted.

**SECTION 2.** The City of Eustis Engineering & Design Standards is incorporated in Land Development Regulations by reference as fully as if set out at length in this section; and from the date on which this section shall take effect, the provisions of such manual shall be controlling.

**SECTION 3.** That all Resolutions or parts of Resolutions in conflict herewith are hereby repealed.

**SECTION 4.** That this Resolution shall become effective immediately on passing.

**DONE AND RESOLVED** this 15<sup>th</sup> day of December, 2016, in regular session of the City Commission of the City of Eustis, Florida.

**CITY COMMISSION OF THE  
CITY OF EUSTIS, FLORIDA**



Michael L. Holland  
Mayor/Commissioner

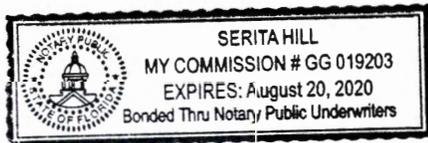
**ATTEST:**

  
Mary C. Montez, City Clerk

**CITY OF EUSTIS CERTIFICATION**

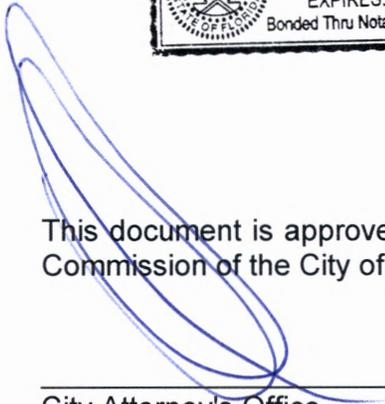
**STATE OF FLORIDA  
COUNTY OF LAKE**

The foregoing instrument was acknowledged before me this 15<sup>th</sup> day of December, 2016, by Michael Holland, Mayor, and Mary C. Montez, City Clerk, who are personally known to me.

  
Notary Public - State of Florida  
My Commission Expires: *Aug 20, 2020*  
Notary Serial No: *GG019203*

**CITY ATTORNEY'S OFFICE**

This document is approved as to form and legal content for use and reliance of the City Commission of the City of Eustis, Florida.

  
City Attorney's Office

*12/15/2016*  
Date

**CERTIFICATE OF POSTING**

The foregoing Resolution No. 16-106 is hereby approved, and I hereby certify that I published the same by posting one (1) copy hereof at City Hall, one (1) copy hereof at the Eustis Memorial Library, and one (1) copy hereof at the Eustis Parks and Recreation Office, all within the corporate limits of the City of Eustis, Lake County, Florida.

12/14/2016  
Date

Mary C. Montez  
Mary C. Montez, City Clerk

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**CITY OF EUSTIS  
ENGINEERING & DESIGN STANDARDS  
MANUAL**



**Adopted by  
City Council**

**1<sup>ST</sup>  
EDITION**

**Subsequent updates to the EDSM will be posted on  
the City Web Site at:**

**[http://www.eustis.net/public\\_works/esd/records/files/ESM.pdf](http://www.eustis.net/public_works/esd/records/files/ESM.pdf)**

**December 2016**

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# **CHAPER ONE**

**SPECIFICATIONS OF  
STANDARD TRANSPORTATION CONSTRUCTION**

**CITY OF EUSTIS  
PUBLIC WORKS DEPARTMENT**

# CHAPTER 1 -STANDARD TRANSPORTATION CONSTRUCTION SPECIFICATIONS

## PREFACE

The specifications set forth herein provide minimum standards for the construction of transportation facilities which meet the following conditions:

1. Facilities to be constructed within the City of Eustis rights-of-way.
2. Facilities to be turned over to the City of Eustis for maintenance.
3. Facilities to become a permanent part of City of Eustis public works system.

These specifications describe the minimum acceptable standards of construction and to promote uniformity where practical. It is felt that adherence to the standards presented in this booklet will benefit both the citizens of Eustis and the operators of the facilities.

The transportation system shall be in general accordance with the city's adopted planning documents and the city's growth management comprehensive plan.

Should any design be submitted which varies appreciably from the standards set herein or uses materials other than those recommended, it should be accompanied by appropriate supporting documentation or engineering studies.

All plans submitted for review shall be in conformance with all federal, state, county, and city regulations and codes. In no case shall minimum standards be less than those established by recognized private and governmental agencies, unless stated otherwise in these specifications.

Construction specifications for stormwater management and water and sewer are listed in Chapter 2 and Chapter 3 respectively.

Footnotes:

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**Editor's note**—Ord. No. 08-14, § 1 adopted July 17, 2008 repealed the former subpt. B, land development regulation, Appendices A—C, and enacted a new subpt. B, land development regulation, Appendices A—C as set out herein. The provisions of the former Appendices A—C derived primarily from Ord. No. 92-18 adopted Aug. 27, 1992, and from subsequent amendatory ordinances.

**Editor's note**—Printed herein are the city Standard Transportation Construction Specifications, as adopted by Ord. No. 08-14 on July 17, 2008. Amendments to the specifications are indicated by parenthetical history notes following amended provisions. The absence of a history note indicates that the provision remains unchanged from the original ordinance. Obvious misspellings and punctuation errors have been corrected without notation. For stylistic purposes, headings and catchlines have been made uniform and the same system of capitalization, citation to state statutes, and expression of numbers in text as appears in the Code of Ordinances has been used. Additions made for clarity are indicated by brackets.

## SECTION 1. - BASIC INFORMATION

Sec. 1.1. - Authority.

- 1.11. Approval. These design standards are accepted and approved by the city commission.

1.12. *Scope and intent.* The intent of these development procedures is to establish minimum engineering requirements for projects submitted to the city. The development procedures will apply to all development and construction projects, both public and private, within the jurisdiction of the City of Eustis.

1.13. *Variances.* Under extreme conditions with specific applications, the following procedures and policies may be altered to meet certain conditions which are beyond the control of the developer provided that such deviations or alterations are acceptable to the city. Final decisions concerning such alterations shall be made by the city manager or his designee.

1.14. *Changes to these standards.* Changes to these standards may be made by resolution adopted by the city commission.

#### Sec. 1.2. - General.

The developer and his engineer shall bear all construction, testing, and inspection costs of the project.

1.21. *Predesign conference.* It is strongly recommended that a predesign conference between the owner, his engineer and the city be held.

#### 1.22. *Plans.*

##### A) *Submission.*

- 1) All construction plans submitted to the city for review and approval shall bear the seal and signature of the Florida Registered Professional Engineer responsible for the project. The address and telephone number of this person shall be shown along with the signature.
- 2) Ten sets of plans and specifications shall be submitted for approval to the city.

##### B) *Assembly.*

- 1) *Sheet size.* The standard size sheet for construction plans submitted to the city for approval shall be 24" x 36". Worksheets and data sheets used in preliminary design work and reviews are not limited to any size, except that which is convenient to handle.
- 2) *Items of construction required.* The developer shall provide as appropriate all necessary improvements in accordance with city specifications, standards and policies.

##### C) *Utility coordination.* It shall be up to the developer to coordinate all utilities within this development.

##### D) *City standards and specifications.* Copies of city standards and specifications may be obtained from the city for the cost of reproduction.

1.23. *Permits.* The developer and his engineers are responsible for obtaining and submitting the required design and construction permits and certification of completion from Florida Department of Transportation, Lake County Public Works, St. Johns River Water Management District, and other regulatory agencies with jurisdiction on the project, to the city.

#### 1.24. *Construction.*

##### A) *Start.*

- 1) *Notification.* The city shall be notified in writing of the proposed date of the beginning of construction of the project. Any time that work is to stop for a period of time in excess of two working days, the city shall be notified of such interruption.
- 2) *Preconstruction conference.* A preconstruction conference shall be held at least two days before the commencement of construction. A 100 percent payment and performance bond shall also be provided. The developer shall be responsible for arranging this conference with the city.

##### B) *Completion.*

- 1) *As-built drawings.* Within two weeks following final inspection, the developer shall submit one mylar set and ten white-background prints of as-built drawings to the city. These

drawings shall be signed by a registered engineer attesting that the accuracy of the facilities shown on the drawings are, in fact, correct.

- 2) *Certificates of compliance.* Certificates of compliance with the specifications furnished by the material supplier shall be submitted on all materials used in the completion of this work.
- C) *Off-site pollution protection.* It will be the developer's responsibility to provide downstream siltation protection during construction. In the event such protection is inadequate, it will be the developer's responsibility to remove any downstream siltation prior to the time of final inspection.

#### 1.25. *Inspection.*

- A) *Periodic.* The city will periodically visit the project site to make a visual inspection of the progress of the work and methods of construction.

Upon observation of work not done in accordance with the plans and specifications, the city will notify the developer's contractor and request that necessary corrections be made or tests performed to assure compliance with the specifications, at no cost to the city.

- B) *Final.* The city shall be notified in writing when the project is complete. Upon receiving a written request for final inspection of the completed work, the representatives of the city, together with the representatives of other interested agencies, shall perform the final inspection within two weeks of the receipt of the request.

1.26. *Maintenance.* All items or systems must be designed in such a manner to minimize future maintenance. A two-year maintenance bond (20 percent) of approved construction cost shall be furnished to the city at the time of final acceptance along with all warranties and manufacturers' manuals for all items to be maintained by the city. All disturbed earthen areas shall be grassed and mulched or sodded prior to acceptance.

1.27. *Transfer of private ownership.* When transfer of private facilities to public ownership takes place, all such private facilities shall be brought up to the current city standards at no cost to the city insofar as construction and maintenance are concerned, before the city will accept such facilities. Proof of satisfactory completion of the project, and submission of quick claim [quit claim] deeds, bills of sale, prior and current permits, warranties, and a 20 percent two-year maintenance bond shall be furnished to the city prior to acceptance.

1.28. *Property ownership.* All facilities to be owned or maintained by the city shall be located on city property, within city right-of-way or on easements dedicated to the city for the uses intended.

1.29. *Time period of approved plans.* Plans shall be valid for construction for a period of one year from the date of city approval only. All items not under construction within one year of the approval date shall require a new approval prior to the commencement of construction.

## SECTION 2. - SITE PREPARATION

The work covered by this section consists of clearing, grubbing, and stripping of the construction site to remove debris within the areas of the rights-of-way, easements, retainage areas, and all other construction areas. Dust control is mandatory. Existing trees and other vegetation that are designated to remain shall be protected in accordance with the city's park and tree protection ordinance.

*Clearing:* Remove and dispose of shrubs, brush, limbs, and other vegetative growth. Remove and dispose of trash piles and rubbish. Protect trees, shrubs, vegetative growth, and fencing which are not designated for removal. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, so as to provide for the safety of employees and others.

*Grubbing:* Grubbing shall consist of the complete removal of all stumps, roots larger than 1 1/2 inches in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris remaining after clearing not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions

excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

*Stripping:* Remove and dispose of all organics and sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass and grass roots in areas to be excavated or filled upon shall be stripped to a depth of four inches. In areas so designated, topsoil shall be stockpiled. Topsoils so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place, shall be disposed of by the contractor unless directed otherwise by the engineer.

All excavation and embankment areas associated with new structures, slabs, and roadways shall be cleared and grubbed to the following depths:

1.	Roadway and paved area:	2 feet below excavated surface.
2.	Building site areas:	2 feet below existing grade and replaced with compacted backfill.
3.	All other areas:	1 foot below completed surface.

**SECTION 3. - EARTHWORK**

**Sec. 3.1. - General.**

The work covered by this section consists of excavation and embankment required for roadway, ditches, channel changes and other works.

Unless otherwise provided, this section shall include all excavation, shaping, filling, sloping and finishing necessary for the construction, preparation, and completion of all embankments, subgrades, shoulders, ditches, slopes, gutters, intersections, approaches, private entrances, and other works all in accordance with the required alignment, grade, and cross sections shown on the plans. Street grades shall not exceed eight percent or be less than 0.4 percent. All streets shall be graded to the full width of the proposed roadway.

**Sec. 3.2. - Excavation.**

All topsoil within the construction areas shall be stripped to an appropriate depth. All areas designated to receive structural fill shall be compacted with inorganic soil to a minimum 95 percent modified Proctor density.

While the excavation is being done and until the work is finally accepted, the contractor shall take the necessary steps to protect the work to prevent loss of material from the construction area due to the action of wind or water. During construction, the area shall be maintained in such condition that it will not constitute a hazard and will be well drained at all times.

**Sec. 3.3. - Disposal of excess material.**

Excess material shall be disposed of in accordance with current city, county, State of Florida, and federal regulations.

Sec. 3.4. - Placing embankment.

Embankments shall be constructed of suitable materials placed in successive level layers not more than 12 inches in thickness, loose measure, for the full width of the embankment, for the full length of the embankment, and compacted to a minimum density of 95 percent of the maximum density value as determined by A.A.S.H.T.O. T-180.

Sec. 3.5. - Shoulders, ditches and slopes.

When the work includes surfacing or paving, the earthwork, including the slopes, and all drainage structures shall have been substantially completed prior to the construction of the base course and pavements.

Before final acceptance by the city, the earth shoulders, slopes, and side ditches shall be completed and shaped to a surface which is within 0.1 foot above or below the true surface shown on the plans. Shoulders shall have a minimum depth of six inches and compacted to 95 percent of A.A.S.H.T.O. T-180 with a minimum Florida Bearing Value of 50 psi and a minimum cross-slope of one-half inch/foot.

Sec. 3.6. - Dust and stormwater runoff controls.

All stripped areas which are bare must be seeded and mulched and watered periodically to prevent dust problems. The contractor shall also install temporary retention ponds, swales and berms to prevent stormwater runoff discharge from the site during construction. The contractor shall provide downstream siltation protection during construction.

Sec. 3.7. - Private property.

All private and public property affected by the construction shall be restored to a condition equal to or better than original conditions. The locations of all existing utilities shall be determined and marked at site prior to the commencement of work.

SECTION 4. - SUBBASE

Sec. 4.1. - Description.

Subbase shall be defined as that portion of the roadbed immediately below the base course including below the curb and gutter, the limits of which will ordinarily include those portions of the roadbed shown in the plans. The limits of the subbase shall extend outward to 12 inches each side beyond the base. On roadways where curbs are utilized, the subbase shall extend to six inches beyond the back of curb.

Sec. 4.2. - Subbase requirements.

The subbase shall be stabilized to a minimum depth of 12 inches and compacted to 98 percent of A.A.S.H.T.O. T-180 FBV 50 psi.

Sec. 4.3. - Stabilization.

The stabilizing material shall be high bearing value soil, sand-clay, limerock, shell, or other material approved by the city and shall meet the physical requirements of F.D.O.T. Standard Specifications section 914-2.

Sec. 4.4. - Construction.

The surface of the subbase shall conform to the lines and grades as defined on the construction plans to a tolerance of 0.05 feet [foot]. If pumping occurs during compaction, the existing wet material shall be removed and replaced by dry material. The method of aeration may be used if permitted by the city.

#### Sec. 4.5. - Testing.

Tests for the subbase bearing capacity thickness and compaction shall be spaced at a maximum of 300 feet apart and shall be staggered to the left, right, and on the centerline of the roadway. The city may direct additional tests when in its opinion conditions warrant additional testing to assure compliance with specifications. All tests shall be the responsibility of the developer/owner for nonpublic improvements. All tests on public improvements shall be performed by a geotechnical/soils engineer.

### SECTION 5. - BASE COURSE

#### Sec. 5.1. - General.

The work specified in this section consists of the construction of a base course composed of limerock or soil cement. It shall be constructed on the prepared subgrade in accordance with these specifications and in conformity with the lines, grades, notes, and typical cross sections shown on the plans.

#### Sec. 5.2. - Materials.

The material used shall conform with the requirements as specified in the Florida Department of Transportation Standard Specifications. Soil cement base shall have a seven-day design compressive strength in accordance with section 6 of these specifications.

#### Sec. 5.3. - Spreading limerock or soil cement.

The limerock or soil cement shall be spread uniformly and extend six inches on each side from the finished surface.

#### Sec. 5.4. - Compacting and finishing base.

For double-course base, the first course shall be bladed if necessary to secure a uniform surface, and shall be compacted to the density specified below, immediately prior to spreading the second course. The base shall have a minimum compacted depth of six inches. Heavy-duty roads shall have a base with a minimum compacted depth of eight inches placed in two lifts.

After spreading is completed, the entire surface shall be scarified and shaped so as to produce the exact grade and cross section after compaction. For double-course bases, this scarifying shall extend to a depth sufficient to penetrate slightly the surface of the first course.

Proper moisture condition shall be maintained uniformly throughout the material during the compaction operation. The limerock material shall be compacted to a minimum density of 98 percent of the maximum density obtainable under A.A.S.H.T.O. Method T-180. Where the base is being constructed in a double course and the specified thickness is more than six inches, the density specified above shall be obtained in both the bottom half and top half of the base. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density determinations on the finished base.

The surface shall be "hard-planed" with a grader immediately prior to the application of the prime coat to remove the thin-glazed or cemented surface, leaving a granular or porous condition that will allow free penetration of the prime material.

If, at any time, the subgrade material should become mixed with the base course material, the contractor shall excavate and remove the mixture, reshape and compact the subgrade, and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.

Sec. 5.5. - Prime/curing.

Base course shall be protected by the application of a bituminous coating in accordance with section 7 of these specifications. The bituminous material shall be applied and sand sealed immediately after the completion of the bituminous application.

Sec. 5.6. - Testing surface.

The finished surface of the base course shall be checked with a template cut to the required cross section and with a 15-foot straight edge laid parallel to the centerline of the road or other approved testing devices. All irregularities greater than +¼ inch shall be corrected by scarifying and removing or adding rock, as may be required, after which the entire areas shall be recompactd as specified herein.

Sec. 5.7. - Tests.

At least one of each of the following tests shall be made on every project by the Geotechnical/Soils Engineer and submitted to the city:

- A) Modified Proctor maximum density determination tests.
- B) Field in-place density tests.
- C) Thickness.

Tests will be required at intervals not to exceed 300 feet. All tests on public improvements shall be performed by a geotechnical/soils engineer.

SECTION 6. - SOIL CEMENT

Sec. 6.1. - Description.

The work specified in this section shall consist of the construction of a soil-cement base course composed of soil and Portland cement uniformly mixed, moistened, compacted, finished and cured in accordance with these specifications, and shall conform to the lines, grades thicknesses and typical cross sections shown on the plans. The base shall be designed to have a minimum in-situ strength of 300 psi. Seven-day laboratory design compressive-strength shall be a minimum of 400 psi for mixed in-place and 350 psi for plant mixed, unless statistical data for the materials used justifies a lesser laboratory strength.

Sec. 6.2. - Testing.

Construction of the soil cement base shall not proceed without 24-hour notice to the city. The following is the minimum information/test data required to be obtained during construction:

- A) Area and date of construction.
- B) Average cement spread.
- C) Uniformity of mix.
- D) Moisture content at time of compaction based on standard Proctor density test (A.A.S.H.T.O. T-134).
- E) Percent compaction.
- F) Compacted thickness.

G) Seven-day compressive strength tests.

In addition to the above data, the contractor shall perform a detailed engineering inspection of the hardened soil-cement base prior to approval for paving to assure that the soil cement base has set up satisfactorily and that no soft areas or surface scabs exist which may need repair. All deficiencies shall be corrected and approved by the city prior to paving.

Sec. 6.3. - Materials.

- A) *Portland cement.* Portland cement shall be type I or type I-P and shall comply with the Standard Specifications for Portland Cement ASTM C-145. Cement which is partially set, lumpy or caked shall not be used. One cubic foot of Portland cement shall be considered to weight 94 pounds.
- B) *Water.* Water shall be clean and free from substance deleterious to the hardening of the soil cement.
- C) *Soil.* The soil for the base course shall be free of organic matter and shall not contain gravel or stone retained on a two-inch sieve or more than 45 percent retained on a No. 4 sieve.

Sec. 6.4. - Construction.

- A) *Responsibility.* The contractor is responsible for completing the project in accordance with plans and specifications.
- B) *Preparation.* Before construction operations are begun, the area to be paved shall be graded and shaped as required to construct the soil cement base in conformance with the grades, lines, thicknesses and typical cross section shown on the plans. Additional soil needed, if any, shall be placed as directed. Unsuitable soil or material shall be removed and replaced with acceptable soil.
- C) *Pulverization.* The soil shall be so pulverized that, at the completion of moist-mixing, 100 percent by dry weight passes a one-inch sieve, and a minimum of 80 percent passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves.
- D) *Application of cement.* The specified quantity of Portland cement required for full depth treatment shall be applied uniformly on the soil. When bulk cement is used, equipment suitable for handling, measuring and spreading the cement shall be used. The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations and shall not exceed the specified optimum moisture content by more than two percent for the soil cement mixture. No equipment, except that used to spread and mix the soil cement, will be allowed to pass over the freshly spread cement until it is mixed with the soil. The application of cement to finishing, inclusive, shall be continuous and surface finishing shall be completed as soon as possible. Spread cement that has been displaced shall be replaced before mixing is started. No cement shall be applied when the soil or subgrade is frozen. The air temperature shall be at least 40 degrees Fahrenheit in the shade and rising.
- E) *Mixing.* After the cement has been applied, it shall be thoroughly mixed with the soil. Mixing shall continue until the cement has been thoroughly blended with the soil in order to prevent the formation of cement balls when water is applied. Any soil and cement mixture that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.
- F) *Application of water and moist mixing.* Immediately after and/or during the mixing of soil and cement, and before beginning the compaction, the moisture content of the soil cement mixture shall be determined by the laboratory and, if required, water shall be applied uniformly in quantities required to obtain proper moisture content. After the final application of water, mixing shall be continued until the water is distributed uniformly through the full depth of the mixture. When water application and mixing has been completed, the percentage of moisture in the mixture and in unpulverized soil lumps, based on oven-dry weights, shall not be more than two percentage points above the specified optimum moisture content, and shall not be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing. The moisture and density requirements shall be determined by the methods prescribed in A.A.S.H.T.O. T-134.

- G) *Compaction.* Prior to beginning of compaction, the mixture shall be in a loose condition for its full depth. The loose mixture shall then be uniformly compacted until the entire depth of the mixture is compacted to at least 95 percent of the maximum density prescribed in A.A.S.H.T.O. T-134 as determined in the field on representative samples of soil cement mixture obtained from the roadway at the time compaction begins. During the compaction operations, shaping may be required to obtain the required grades and cross section. The maximum time allowed between the last moist mixing and compaction shall be 60 minutes.
- H) *Finishing.* After the mixture has been initially compacted, the surface of the soil cement shall be shaped to the required lines, grades and cross section. During the shaping operations, the surface shall be lightly scarified to loosen any imprints left by the compacting or shaping equipment, when deemed necessary. The resulting surface shall then be compacted to the specified density with a pneumatic tire roller. Rolling shall be supplemented by broom-dragging, if required. The moisture content of the surface material must be maintained at not less than its specified optimum moisture content during finishing operations. Surface compaction and finishing shall be done in such a manner as to produce a smooth, dense surface, free of surface compaction planes, cracks, ridges or loose material. Surface-finishing methods may be varied, provided a smooth, dense surface, free of surface compaction planes, is produced.
- I) *Surface requirements (scalping or hard-planing).* After compaction and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any section of the base, the surface shall be tested with a template cut to the required crown and/or with a 15-foot straight-edge laid parallel to the centerline, and all irregularities greater than one-fourth inch shall be immediately corrected with a blade adjusted to the lightest cut, which will ensure a surface that does not contain depressions greater than one-fourth inch under the template or the straight-edge. The material removed shall be wasted. Additional wetting during and after this final shaping operation will be required to keep the base continuously moist.
- J) *Prime curing.* The curing material shall be applied as soon as possible after the completion of finishing operations. The finished soil cement shall be kept continuously wet until the curing material is placed. After the soil cement has been finished as specified herein, it shall be protected against drying for seven days by the application of bituminous coating. Prime and curing materials shall conform to section 7 of these specifications.
- K) *Construction joints.* Prior to the beginning of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a vertical face.
- L) *Thickness.* During various stages of construction, test holes or trenches shall be dug in the mixture to determine the thickness. After the base is completed, test holes shall be dug or drilled at intervals of not more than 300 feet, or at closer intervals, if necessary, and the thickness of the base shall be determined from measurements made in these test holes. Where the base is deficient in thickness by more than one-half inch, the area of deficient base shall be removed and replaced by base of the required thickness, at the contractor's expense, except that, at the city engineer's option, such deficient thickness base may be left in place provided the deficiency is not more than one inch. This deficiency may be made up in asphaltic concrete and the grade control can be met.

#### Sec. 6.5. - Opening to traffic.

The contractor will not be permitted to drive heavy equipment over the completed sections, but light weight pneumatic-tired equipment may be permitted after the surface has hardened sufficiently to prevent the equipment marking the surface and provided the protection and curing specified are not impaired. Completed section may be opened to light traffic after 24 hours protection provided the surface has hardened sufficiently to prevent marking by traffic and has been inspected by the city. An application of sand shall be done prior to opening to construction traffic.

#### Sec. 6.6. - Maintenance.

The contractor shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these specifications. The bituminous curing coating shall be maintained until the wearing surface is constructed.

Sec. 6.7. - Inspection.

After a minimum of seven days have elapsed and prior to applying the asphalt wearing surface, an inspection of the base shall be performed by the city, the geotechnical/soils engineer, and the contractor. Prior to commencing paving operations, all deficiencies shall be corrected and approved by the geotechnical/soils engineer, prior to approval by the city.

SECTION 7. - PRIME AND TACK COATS FOR BASE COURSES

Sec. 7.1. - General.

The work specified in this section consists of the application of bituminous material, on a previously prepared base, in accordance with these specifications and in conformity with the lines, grades, dimensions, and notes shown on the plans.

Sec. 7.2. - Materials.

The materials used shall be as follows:

A) Prime coat.

- a. Cutback asphalt, grade 7RC-SS-1, SS-1H, special MS-emulsion, diluted at the ratio of six parts emulsified asphalt to four parts water.
- b. Cutback asphalt, grade RC-70.

B) Tack coat.

- a. Asphalt cement, viscosity grades AC-20 or AC-30.
- b. Emulsified asphalt, grade RS-2, SS-1, SS-1H, special MS-emulsion, diluted at the ratio of six parts emulsified asphalt to four parts water.

For the prime and tack coat, any one of the specified bituminous materials may be used at the option of the contractor, unless a specific type and grade is called for on the plans.

Sec. 7.3. - Cleaning the base.

Before any bituminous material is applied, all loose material, dust, and foreign material which might prevent proper bond with existing surface shall be removed for the full width of the application. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime or tack coat will adhere. Where the prime or tack coat is applied adjacent to curb and gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous materials.

Sec. 7.4. - Weather limitations.

No bituminous material shall be applied when the temperature of the air is less than 40 degrees Fahrenheit in the shade, or when the weather conditions or the condition of the existing surface is unsuitable.

Sec. 7.5. - Application of prime coat.

The surface to be primed shall be clean and free of standing water. For limerock bases, the glazed finish shall have been removed leaving a granular or porous condition that will allow free penetration of bituminous material. The temperature of the prime material shall be between 100 degrees Fahrenheit and 150 degrees Fahrenheit. The actual temperature will be that which will insure uniform distribution. The material shall be applied by means of a pressure distributor. The amount of bituminous material applied shall be not less than 0.10 gallon per square yard for limerock base and not less than 0.15 gallon per square yard for sand clay, soil cement, or shell base. The amount to be applied will be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly and uniformly, with no excess. Where asphaltic pavement abuts concrete curbing, the vertical abutting edge shall receive a uniform coating of tack applied so as to avoid puddles, etc.

A light uniform application of clean sand shall be applied prior to opening the primed base to traffic, in which case the sand shall be rolled with a traffic roller. If warranted by traffic conditions, the application shall be made only on one-half of the width of the base at one time, care being taken to secure the correct amount of bituminous materials at the joint.

The base shall be sufficiently moist in order to obtain maximum penetration of the asphalt.

#### Sec. 7.6. - Application of tack coat.

Where a bituminous surface is to be laid and a tack coat is required, it shall be applied as herein specified. On newly constructed base courses, the application of the tack coat shall follow the application of the prime coat, immediately prior to placing the wearing surface, when the tack coat is required. In general, a tack coat will not be required on primed bases, except in areas which have become excessively dirty and cannot be cleaned in areas where the prime has cured and lost bonding effect, or where the prime coat has worn away.

The tack coat is to be applied with a pressure distributor. The bituminous material shall be heated to a suitable consistency as designed or as stated in section 7.5. The bituminous material shall be applied at the rate between 0.02 gallon and 0.08 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material and shall be kept free from traffic until the wearing surface is laid.

### SECTION 8. - ASPHALTIC CONCRETE SURFACE COURSE

#### Sec. 8.1. - General.

The work specified in this section consists of the application of asphaltic concrete surface course composed of a mixture of aggregates and, if necessary, mineral filler and asphalt cement to produce the desired stability hereinafter described, properly laid upon a prepared base in accordance with these specifications and in conformity with the lines, grade, thickness and typical cross section shown on the plans. This work shall include the conditioning of the existing surface or base. Skid-resistant surfaces shall be installed as required by the city. Road surface shall be graded with a minimum cross-slope of one-fourth inch/foot.

#### Sec. 8.2. - Asphaltic concrete mixes.

Asphaltic concrete mixes shall meet the following specifications when called for in the plans and specifications:

Type	Job Mix Specification	Min./Avg. Compacted ( ) Max Lift	Minimum Marshall Stability	Application
Type S-1	Current FDOT Specification	1½" (2")	1,000 lb.	Wearing Course
Type S-3	Current FDOT Specification	1¼" (2")	1,000 lb.	Wearing Course
Type III	Current FDOT Specification	1" (2")	1,000 lb.	Wearing Course
Type II	Current FDOT Specification	— (2")	500 lb.	Leveling Course
Type FC-1	Current FDOT Specification	¾" (1")	500 lb.	Friction Course
Type FC-2	Current FDOT Specification	3/8" (5/8")	N/A	Friction Course
Type FC-3	Current FDOT Specification	3/8" (5/8")	N/A	Friction Course
Type	Current FDOT Specification	5/8" (1")	500 lb.	Friction Course

The minimum thickness of the pavement is 1¼ inches with type S-3 asphaltic concrete. Heavy-duty roads shall have a wearing surface consisting of 1½ inches of S-1 asphaltic concrete overlaid with a one-inch friction course. The thickness of the pavement shall be determined from the length of core, at least two inches in diameter, taken at random points on the cross section and along the roadway. Each core shall represent a section not longer than 300 feet.

If the city believes that the number of cores taken is insufficient to properly indicate the thickness of the pavement, it may request additional core at locations designed by the city. All additional costs shall be borne by the contractor.

When the deficiency in thickness is in excess of one-fourth inch, the contractor shall correct the deficiency either by replacing the full thickness for a length extending at least 50 feet from each end of the deficiency area, or (when permitted by the city) by overlaying. Normally an overlay will not be permitted in a concrete curb section.

### Sec. 8.3. - Construction methods.

The mixture shall be spread on the surface designated only when the surface previously prepared is intact, firm, properly cured and dried; and only when the air temperature in the shade and away from artificial heat is above 40 degrees Fahrenheit and rising.

The mixture shall be delivered on the road in ample time to permit the spreading, rolling and surface testing during daylight hours. The temperature of the mixture at the time of spreading shall be between 260 and 310 degrees Fahrenheit and shall not exceed 340 degrees Fahrenheit at the plant.

Material shall be delivered to the job site with sufficient frequency that the paving operation can continue without interruption.

Depressions which may develop after the initial rolling shall be remedied by removing the mixture laid, and adding new material to bring such depressions to a true surface. Such portions of the completed course that are defective in surface planeness, compaction or composition, or that do not comply with the requirements of these specifications, shall be removed and replaced with suitable mixture properly laid in accordance with these specifications.

Verified construction joints shall be constructed prior to the commencement of the ongoing paving operation. All cold joints will be prepared according to the Florida Department of Transportation Specifications. The vertical surface of all existing asphaltic concrete mixes at cold joints shall be mopped with an approved liquid bitumen material so as to provide a watertight joint at the interface of the two mixes.

### Sec. 8.4. - Finished surface requirements.

For the purpose of testing the finished surface, the contractor shall provide a 15-foot rolling straight edge and standard template cut to the true cross section of the road. These shall be available at all times during construction so that the city may check the finished surface. The contractor shall provide and designate an employee whose duty it is to use the straight edge and template in checking all rolled surface under the direction of the city. Vertical measurement from a string line between curbs to determined crown may be accepted as an alternate. The finished surface shall be such that it will not vary more than one-fourth inch from the 15-foot rolling straight edge applied parallel to the centerline of the pavement and shall be of uniform texture and compaction. The lip of the asphalt shall be higher than the gutter by one-fourth to one-half inch. The surface shall have no pulled, torn or loosened portions and shall be free from segregation, sand streaks, sand spots, or ripples. Irregularities of the surface exceeding the above requirements shall be corrected by the contractor who has the option of selecting one of the following methods:

- A) *Removing and replacing.* If correction is made by removing and replacing the pavement, the removal must be for the full depth of the course and extend at least 50 feet on either side of the defective area, for the full width of the paving lane.
- B) *Overlaying.* If correction is made by overlaying, the overlay shall cover the length of the defective area and taper uniformly to a feather-edge thickness at a minimum distance of 50 feet on either side of the defective area. The overlay shall extend full width of the roadway. Care shall be taken to maintain the specified cross slope. The mix used for the overlay may be adjusted as necessary for this purpose by the city. Overlaying will not be permitted when the finished pavement surface is a friction course or abuts concrete curbs.
- C) *Other methods.* For courses which will not be the final pavement surface, correction of minor straight-edge deficiencies by methods other than specified above may be approved by the city.

### Sec. 8.5. - Tests.

During construction of the asphaltic concrete wearing surface, the following tests must be completed and reports submitted to the city before acceptance can be given:

- A) *Density and depth checks.* One test per 300 lineal feet of roadway (minimum two tests per street). Minimum acceptable density for each course of asphaltic concrete material shall be 93 percent of the design unit weight in the job mix formula.

All tests and job mix formulas shall be made by an independent testing engineer as approved by the city and all reports shall be signed and sealed by a registered professional engineer for the State of Florida.

## SECTION 9. - SIDEWALKS/BIKEPATHS/CONCRETE CURB/DRIVEWAY

### Sec. 9.1. - General.

The work specified in this section consists of the construction of curb, curb and gutter, driveway, or sidewalks/bikepaths of Portland cement concrete. Such works shall be constructed in accordance with these specifications and in conformity with the lines, grades, dimensions, and notes shown on the plans. Should the contractor so elect, he may use a curb machine. All concrete shall be finished as recommended by the P.C.A. Sidewalks/bikepaths shall have a minimum of one-quarter inch per foot positive slope from the top of curb or edge of pavement, unless otherwise specifically approved by the city.

- A) *Sidewalks.* Sidewalks shall be four-inch thick concrete and six-inch thick at driveways with fiber on a compacted subgrade.
- B) *Bicycle paths.* Bicycle paths shall be four-inch thick fiber on a compacted subgrade. Bicycle paths shall be marked with paint. Bicycle paths constructed with asphaltic concrete shall be in accordance with section 8.
- C) *Driveways.* Driveways shall be six-inch thick concrete with fiber on a compacted subgrade from the property to the edge of the pavement. Driveways constructed with asphaltic concrete shall be in accordance with section 8. A typical driveway apron design is shown in Drawing No. 1 [see attachment to this chapter].
- D) *Curb and gutter.* The curb and gutter shall be a minimum of 24 inches wide of FDOT Type F (standard curb and gutter) or Miami curb. The curb and gutter flow line grades shall run parallel to the road centerline grade. The minimum allowable flow line grade shall be 0.3 percent, except in intersections where flatter grades are needed. All curbing and valley gutter shall be constructed of concrete in accordance with FDOT standards.

#### Sec. 9.1.1. - Design considerations.

- (a) The choice of the proper location for access facilities (driveways) must involve consideration of the amount of conflict which can be expected both within the parking area and on the abutting streets. One primary concept which shall be followed is to reduce the number of connections to a practical minimum, thus providing fewer locations where conflicts may occur.
- (b) The area to which the driveway provides access shall be of sufficient size to allow all necessary functions for loading, unloading, and parking maneuvers to be carried out on private property and completely off the street right-of-way.
- (c) Driveways shall be constructed to conform to the existing paved street grade or grade approved by [the] city manager or his designee for nonpaved streets.
- (d) Parking areas shall be so designed and marked as to provide for orderly and safe movement and storage of vehicles:
  - (1) Backout parking on a public street and/or highway shall not be permitted.
  - (2) The minimum distance from the street right-of-way line at any ingress or egress driveway to any interior service drive or parking space with direct access to such driveway shall be 20 feet.

- (3) The minimum distance from the street right-of-way line on any major ingress or egress driveway to any interior service drive or parking space having direct access to such driveway shall be 100 feet (a major driveway is defined as the main ingress or egress point to a public street or highway from a site or a major development such as a shopping center, multiple-family development, industrial park, etc.).

(Code 1959, § 19-13.05)

Sec. 9.2. - Materials.

Unless otherwise shown on the plans, concrete shall be class I, 3,000 p.s.i.

Sec. 9.3. - Construction methods.

Excavation shall be made to the required depth and the subgrade or base shall be compacted.

The concrete shall be placed in the forms to the depth specified and tamped and spaded until mortar entirely covers its surface. The top of the curb or gutter shall be floated smooth and the edges rounded to the radius shown on the plans.

Sec. 9.4. - Joints.

Joint sections may be formed by the use of dummy joints (either formed or sawed) or by the use of sheet metal templates. If sheet metal templates are used, they shall be of the dimensions and shall be set to the lines shown on the plans. The templates shall be held firmly during the placing of the concrete and shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place. Dummy joints shall be spaced at ten-foot intervals for curb and five-foot intervals for sidewalks/bikepaths.

The joints shall be one-fourth the depth of the concrete. Expansion joints shall be placed in sidewalks/bikepaths at a maximum of 20 feet, at driveways, sidewalk/bikepath intersections, etc. A half-inch expansion joint shall be installed between all curbs and any abutting structures.

Sec. 9.5. - Finishing.

- A) *Surface requirements.* The gutter or flow-line section or curb shall be tested with a ten-foot straight edge laid parallel to the centerline of the roadway, and while the concrete is still plastic. Irregularities in excess of one-fourth inch shall be immediately removed.
- B) *Repair of minor defects.* The forms shall be removed within 24 hours after the concrete has been placed, and minor defects then filled with mortar composed of one part Portland cement and two parts fine aggregate. Plastering will not be permitted on the face of the curb, and any rejected curb, curb and gutter, or valley gutter shall be removed and replaced.
- C) *Final finish.* The top of the curb, and the face from the top to eight inches below, shall be given a surface finish while the concrete is still green. In general, only a brush finish will be required.

Sec. 9.6. - Curing.

All curbs shall be covered with suitable material and kept moist for a period of three days, or longer if necessary, and shall be protected in a satisfactory manner from damage until acceptance of the work. If curing compound is used, moistening is not required.

Sec. 9.7. - Backfilling and compaction.

After the concrete has set sufficiently but not later than three days after pouring, the spaces in front and back of the curb shall be refilled to the required elevation with suitable material, which shall be placed and thoroughly compacted in layers not thicker than six inches.

Where bases are to be constructed adjacent to the curb, the concrete shall be properly backfilled and shall set for a period of not less than three days before any base material is placed against it.

Sec. 9.8. - Requirements for machine-laying.

As a specific requirement for machine-laid curb and gutter, contraction joints shall be sawed unless an alternate method of construction is approved in advance. Joints on curbs shall be provided at intervals of ten feet, except where shorter intervals are required for closure, but no joints shall be sawed or constructed at intervals of less than five feet. Sidewalks may also be machine laid.

Sec. 9.9. - Handicap ramps.

Ramps shall be required at all intersections and as prescribed by law. At each intersection, there must be a sufficient number of handicap ramps to facilitate ingress and egress from both sides of the roadway. The slope of the ramp shall not exceed a ratio of 12 horizontal to 1 vertical.

Sec. 9.10. - Stormwater inlet structure.

Stormwater runoff inlet structure along the pavement edge shall be FDOT index 210, type 3 curb inlet. Inlet structures with top grating are strictly prohibited due to frequent clogging and maintenance problems.

SECTION 10. - GRASSING AND MULCHING

Sec. 10.1. - General.

The work specified in this section shall consist of all grassing efforts on road shoulders, embankments, and other areas left barren by construction in order to establish a dense stand of grass.

Sec. 10.2. - Materials.

The grass seed shall be common Bermuda and Bahia, as a minimum. The mulch shall consist of thoroughly shredded straw or hay. All seed shall meet the requirements of the state department of agriculture and consumer services. The chemical composition of the fertilizer shall be 8-8-8 or other chemical composition specified in the plans.

Sec. 10.3. - Construction methods.

Construction methods shall be in accordance with section 570 of the Florida D.O.T. standard specifications for road and bridge construction.

Seed will be applied at not less than the following rate:

Bermuda	30 pounds per acre
Bahia (Argentina)	120 pounds per acre

Fertilizer shall be applied at the rate of 1,000 pounds per acre.

Sec. 10.4. - Sodding.

Sodding shall be in accordance with section 575 of the Florida D.O.T. standard specifications. Sod destroyed or damaged by construction will be replaced with the same existing type of grass in place.

Sec. 10.5. - Cleanup.

All materials after each day's work shall be removed from all sidewalks and roadways used by the general public.

SECTION 11. - PAVEMENT MARKINGS

Sec. 11.1. - General.

The work specified in this section shall consist of the design and installation of pavement markings as shown on the plans in accordance with these specifications and as approved by the city. Temporary markings shall be used as required by the city.

Sec. 11.2. - Materials.

- A) *Paint.* All paint used for pavement markings shall conform to section 971.13 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.
- B) *Thermoplastic compounds.* All thermoplastic compounds used for pavement markings shall conform to section 711-2 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction. Only alkyd materials shall be used.
- C) *Reflective pavement markers.* All reflective pavement markers shall conform to section 706 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.
- D) *Glass spheres.* All glass spheres for reflective traffic paint shall conform to section 971-14 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

Sec. 11.3. - Installation.

- A) *Surfaces.* All surfaces shall be cleaned prior to the start of installation.
- B) *Painted markings.* Painted traffic markings shall be installed in accordance with section 710 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and the Manual on Uniform Traffic Control Devices (FHWA). Paint may be used only on private development improvements or as temporary markings.
- C) *Thermoplastic traffic markings.* Thermoplastic traffic markings shall be installed in accordance with section 711 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and the Manual on Uniform Traffic Control Devices (FHWA). Alkyd materials may be applied immediately after final compaction of asphaltic concrete.
- D) *Reflective pavement markers.* All reflective pavement markers shall be installed in conformance with section 706 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

SECTION 12. - TRAFFIC SIGNS AND SIGNALS

Sec. 12.1. - General.

The work specified in this section consists of the design and installation of traffic signs and signals as shown on the plans in accordance with these specifications and as approved by the city. All materials and

installation shall be in accordance with the specifications of the Manual on Uniform Traffic Control Devices for Streets and Highways.

Sec. 12.2. - Materials.

- A) *Sign panel.* Sign panels shall be aluminum or galvanized steel.
- B) *Sign supports.* Roadside sign supports shall be aluminum for frangible supports and aluminum or galvanized steel for breakaway supports and overhead sign supports. All sign supports shall be installed in concrete footing.
- C) *Painting.* Painting panels for nonreflectorized backgrounds shall be one spray coat of primer and two finish coats of baked enamel. Painting and sheathing for reflectorized signs shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways.

Sec. 12.3. - Construction.

Stop signs for local streets shall be 30 inches and 36 inches for all others. All stop signs shall be placed on round, aluminum posts.

Road name signs shall be six inches high with a length of 24 inches minimum to 36 inches maximum.

All signs shall not be less than six feet from the edge of a paved shoulder, or, if none, 12 feet from the edge of the traveled way. A lesser clearance may be acceptable to the city if such measure is justifiable by the developer.

Signs shall be mounted approximately at right angles to the direction of, and facing the traffic that they are intended to serve. Signs shall be mounted a minimum height of seven feet, measured from the bottom of the sign and level with the roadway edge.

If, at any time prior to final acceptance, an unforeseen need becomes apparent for signing that was not shown on the approved plans, the city may require additional sign(s) in the interest of public safety and as a condition of city acceptance.

SECTION 13. - ILLUSTRATIONS AND DRAWINGS

The illustrative drawings that may be required in this section are on file with the city engineer.

# **CHAPTER TWO**

**SPECIFICATIONS OF  
STANDARD STORMWATER MANAGEMENT FACILITY CONSTRUCTION**

**CITY OF EUSTIS  
PUBLIC WORKS DEPARTMENT**

## CHAPTER 2 - STANDARD STORMWATER MANAGEMENT FACILITY CONSTRUCTION SPECIFICATIONS

The [These] specifications provide minimum standards for the construction of a stormwater management facility which meet conditions as follows:

1. Facility to be constructed within the City of Eustis.
2. Facility to be turned over to the homeowner's association or to the City of Eustis for operation.
3. Facility to become a permanent part in the City of Eustis.

These specifications describe minimum acceptable standards of construction and to promote uniformity where practical. It is felt that adherence to the standards presented will benefit both the citizens of Eustis and the operators of the facility.

Stormwater management shall be in general accordance with the city's adopted planning documents including (A) Stormwater Management Master Plan, 1991, and (B) City of Eustis Comprehensive Plan.

Should any design be submitted which varies appreciably from the standards set herein or uses materials other than those recommended, it should be accompanied by appropriate supporting documentation or engineering studies.

All plans submitted for review must be in conformance with all federal, state, county, and city regulations and codes. Minimum standards will not be less than those established by recognized private and governmental agencies, unless stated otherwise in these specifications.

Plans submittal, site preparation and earthwork shall be in accordance with Chapter 1 of these specifications. Construction specifications for transportation and water and sewer are listed in Chapter 1 and Chapter 3, respectively.

The developer and his engineers are responsible for obtaining and submitting the required design and construction permits and certification of completion from St. Johns River Water Management District, Florida Department of Transportation, Lake County Environmental Services, and other regulatory agencies with jurisdiction on the project, to the city.

Footnotes:

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**Editor's note**—Ord. No. 08-14, § 1 adopted July 17, 2008 repealed the former subpt. B, land development regulation, Appendices A—C, and enacted a new subpt. B, land development regulation, Appendices A—C as set out herein. The provisions of the former Appendices A—C derived primarily from Ord. No. 92-18 adopted Aug. 27, 1992, and from subsequent amendatory ordinances.

**Editor's note**—Printed herein are the Standard Stormwater Management Facility Construction Specifications, as adopted by Ord. No. 08-14 on July 17, 2008. Amendments to the specifications are indicated by parenthetical history notes following amended provisions. The absence of a history note indicates that the provision remains unchanged from the original ordinance. Obvious misspellings and punctuation errors have been corrected without notation. For stylistic purposes, headings and catchlines have been made uniform and the same system of capitalization, citation to state statutes, and expression of numbers in text as appears in the Code of Ordinances has been used. Additions made for clarity are indicated by brackets.

**Cross reference**— Development standards for stormwater management, § 114-381 et seq.; floods, ch. 118.

## SECTION 1. - STORMWATER RUNOFF STORAGE BASINS

### Sec. 1.1. - Description.

Stormwater runoff storage basins include retention and detention basins in a new development. The basins shall be rectangular, square, round or irregular shapes. The basins shall be designed to store stormwater runoff based on the appropriate storm events as described in art. V of chapter 114, Code of Ordinances.

### Sec. 1.2. - Requirements.

Stormwater runoff storage basins shall be constructed with or without overflow structures. Total runoff on-site containment is required. The bottom elevation of the basins shall be a minimum of three feet above the seasonal high water elevation for dry basins. Percolation tests for the storage basins shall be provided to the city prior to construction. All basins shall be cleared of organic matter and mud and filled with clean sand. The storage basins shall be two to eight feet deep with a maximum side slope not to exceed 1:4.

### Sec. 1.3. - Overflow structures.

Overflow structures of the storage basins, if required, shall be constructed of corrosion-resistant materials, such as concrete or aluminum, with skimming device. The skimming device shall be of aluminum or stainless steel construction and shall be placed at a minimum elevation of 12 inches below the top of the berm. The outfall of the overflow structure shall be underground drain pipe directed to the adjacent storm sewer, canal, lake or river approved by the city and other regulatory agencies. A typical detail of the overflow structure is shown in Drawing No. 1 at the end of this chapter [which is on file with the city engineer].

### Sec. 1.4. - Inlet structures.

Inlet structures to the storage basins shall be concrete flume type design with energy dissipators. The flume shall be constructed with a minimum of four-inch-thick reinforced concrete slab parallel to the finished side slope of the basins. The apron of the flume shall extend horizontally five feet toward the center of the basin. Underground drain pipe to the storage basins shall be mitered end section type design, FDOT Index 272, connected and flushed with the concrete flume. The inlet structures shall be constructed on the compacted subbase. A typical detail of the inlet structure is shown in Drawing No. 2 [at the end of this chapter] [which is on file with the city engineer].

### Sec. 1.5. - Berms.

The minimum width of the basin berms shall be 20 feet for easement and maintenance purposes. The berms shall be constructed with compacted clean sand or clay and free of organic materials. The berm shall not be more than two feet above the finished ground level.

### Sec. 1.6. - Sod, seed and mulch.

Immediately after completion of grading, all side slopes of the storage basins shall be sodded to the horizontal levels extending two feet from the edge of the slopes. The flat bottom and top of the basins beyond the sodded areas shall be seeded and mulched. Frequent irrigation of the grassed areas is required daily for the first seven days to ensure germination and twice a week thereafter for a period of three weeks.

### Sec. 1.7. - Fencing.

Fencing of stormwater storage basis shall be considered under certain circumstances for safety purposes. All basins with standing water more than three months in a year shall be fenced. Dry basins with depths greater than four feet or side slopes steeper than 1:4 shall be fenced. All fences and gates shall be six feet high chain link type fencing with 12 feet wide gates for maintenance purposes.

### Sec. 1.8. - Operation and maintenance.

The design and construction of the storage basins shall provide the intended function of the system during storms. The assigned authorities shall provide regular maintenance of the storage basins such as mowing, cleaning of inlet and outlet structures, debris removal from the basins, flushing inlet and outlet lines and regular inspections of the inlet and outlet structures, berms and basins for leaks, erosion, etc.

## SECTION 2. - DRAINAGE SWALES

### Sec. 2.1. - Description.

Drainage swales are mainly used for runoff conveyance rather than storage or the combinations of both. Swales are normally shallow depressions not greater than three feet in depth with mild slopes to facilitate ease of maintenance. Swales are normally constructed parallel to both sides of the road to direct runoff from the roads and convey the excess runoff to the storage basins.

### Sec. 2.2. - Requirements.

Swales shall be constructed to provide a top width-to-depth ratio of the cross section equal to or greater than 6:1, or side slopes equal to or greater than three feet horizontal to one foot vertical. Swale blocks shall be provided along the flow path on steep areas to reduce erosion problems. The top elevation of the swale blocks shall be a minimum of six inches below the adjacent ground level. The swales shall have a minimum grade of 0.05 percent for effective runoff conveyance.

### Sec. 2.3. - Inlet structures.

Runoff inlet structures from the swales to the storage basins through underground drainage pipes shall be in accordance with FDOT Index 232. The use of inlet structures on the swales is strongly discouraged due to maintenance problems. Direct flow of runoff through a continuous swale system to the storage basin spillway is highly recommended.

### Sec. 2.4. - Sodding.

All swales shall be sodded two feet beyond the top horizontal level to enhance stability and operation efficiency. The contractor may elect to temporarily seed and mulch the swales prior to the construction of buildings and provide permanent sodding of the swales at a later time after the building is constructed. In this case, the contractor shall exercise care and prudent judgement to restore the swale grade lines to the designed grades in accordance with the approved plans.

## SECTION 3. - STORM SEWER AND CULVERT

### Sec. 3.1. - Description.

Storm sewer is generally used to convey stormwater runoff from the inlet structures to the storage facility. A culvert is a flow conduit beneath and across a driveway or infrastructures. Both the storm sewer and culvert are normally large conduits to convey a large volume of runoff within a short period of time.

### Sec. 3.2. - Requirements.

Both the storm sewer and culvert shall be of reinforced concrete pipe (RCP) or corrugated metal pipe (CMP) and shall be a minimum of 15 inches in diameter. All storm sewers and culverts shall be designed and constructed to provide a minimum flow velocity of two feet per second and a maximum velocity of 15 feet per second. All storm sewers shall be designed for the tailwater conditions of the receiving facility, or water, and the hydraulic gradient of the drainage system is to provide a positive flow path for any storm events.

Sec. 3.3. - Reinforced concrete pipe.

Reinforced concrete pipe shall be a minimum of class III, conforming to the ASTM Designation C-76. The joints shall have a continuous O-ring rubber gasket, or approved equal, which fits snugly in the annular space between the beveled surfaces of the tongue and groove ends of the pipe to form a flexible watertight joint. There shall be no exposed metal in the joint, except that allowed by ASTM and FDOT for "chair". Elliptical concrete pipe joints shall be wrapped with filter fabric extending one foot on both sides of the joint and a two-foot overlap on the top.

Sec. 3.4. - Corrugated metal pipe.

Corrugated aluminum alloy pipe shall conform to the current A.A.S.H.T.O. Standard Specification M-196. Aluminum coated steel sheets for corrugated metal pipe shall conform to the current A.A.S.H.T.O. Standard Specification M-244. Metallic coated corrugated steel pipe shall conform to the current A.A.S.H.T.O. Standard Specification M-36. All corrugated metal pipe installed shall have a continuous helical lock seam or a continuous welded helical seam. Riveted seams, spot welded seams, or non-helical corrugated metal pipe are prohibited.

The ends of all corrugated metal pipe shall be recorruagated and the pipe supplied with a metal banding system. The metal band system shall have a rubber gasket, or approved equal, which shall fit snugly in the space between the recorruagated end and metal band. The band shall be a minimum of two feet in width.

All joints within six feet of a pavement shall be wrapped with typar, or approved equal. The material shall extend a minimum of three feet on both sides of the joint and shall have a two-foot overlap on the top of the pipe. All joints shall be wrapped with filter fabric.

Sec. 3.5. - Pipe slopes.

The minimum pipe slopes of the sewer shall be as follows:

Pipe Diameter (inches)	Minimum Slope	
	RCP (percent)	CMP (percent)
15	0.40	1.03
18	0.30	1.00
24	0.20	0.70
30	0.15	0.50
36	0.10	0.40
42	0.08	0.30

48	0.07	0.25
54 or larger	0.05	0.20

Sec. 3.6. - Sewer manholes.

The storm sewer manholes shall be of precast concrete construction and shall have a minimum inside diameter of 48 inches.

- A) Precast reinforced manholes shall be in accordance with ASTM Designation C478, with pre-formed flexible plastic joint sealer conforming to Federal Specification SS-S-0210 (GSA-FSS).
- B) Manhole frames and covers shall be gray cast iron conforming to ASTM Designation A48, Class 30, and shall have a minimum 24 inches opening. Covers shall be marked with "Storm Sewer" signs. Frames and covers shall be fully bedded in mortar to the correct finish grade elevation, with adjustment brick courses placed below, as detailed for precast manholes. There will be no steps allowed in manholes.
- C) Manhole flow channels shall have smooth and carefully shaped bottoms, built up sides and benching constructed from concrete. Channels shall conform to the dimensions of the adjacent pipe and provide changes in size, grade and alignment evenly. A flow channel shall be formed in the invert of all inlets, manholes and junction boxes and shall extend to the spring line of the pipe.
- D) Precast manholes, inlets and junction boxes shall be in accordance with ASTM C-478. The inlet and outlet pipes shall be flushed with the inside face of the wall. Mortar bonding shall be required between pipe and structure wall.
- E) The interior surfaces of the manholes shall be protected by two coats of Koppers Bitumastic No. 300M, or approved equal. The exterior surfaces shall receive two coats of Koppers Bitumastic Black Solution, or approved equal.

Sec. 3.7. - Pipe depth and protection.

The minimum cover for storm sewer shall be two feet from the top of the pipe to finish grade. The minimum cover for culvert from the bottom roadway base to the exterior pipe is 12 inches.

Sec. 3.8. - Maximum lengths of pipe.

The maximum runs of pipe between the manholes are as follows:

Pipe Size (inches)	Maximum Length (feet)
15 to 18	300
24 to 36	400
42 and larger	500

### Sec. 3.9. - Laying pipe.

All pipe shall be carefully laid, true to the lines and grades as shown on the plans. For pipe laid with rubber gasket joints, any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as one-fourth inch, or which would produce a gap exceeding one-half inch between sections of pipe for more than one-third of the circumference of the inside of the pipe, will not be acceptable, and where such occurs, the pipe shall be relaid. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap. Video inspection shall be submitted to the Public Works Inspector.

### Sec. 3.10. - Backfilling.

Backfilling shall progress immediately when the construction and testing of the pipe are complete. All backfill material shall be free of organic material, construction debris, concrete, and other deleterious materials. The initial backfill shall be carefully deposited on both sides of the pipe and uniformly compacted around the barrel of the pipe until sufficient fill material has been placed to provide a cover of two feet above the crown of the pipe. The backfill across the roads shall be placed and compacted to an average density of 95 percent of the maximum density value as determined by A.A.S.H.T.O. T-180.

### Sec. 3.11. - Culverts.

Culverts crossing the street or driveway shall be terminated with endwall or mitered end section at both ends. Drain pipe outfall to the open channel shall also be equipped with endwall or mitered end section. Endwall shall be in accordance with FDOT Index 250, 261 or 266. Mitered end section shall be in accordance with FDOT Index 273.

## SECTION 4. - UNDERDRAIN SYSTEM

### Sec. 4.1. - Description.

An underdrain system is specifically used for extreme conditions where other means of positive drainage conveyance are exhausted. The underdrain system tends to clog and therefore requires regular inspection and cleaning. An underdrain system, if used, shall be preapproved by the city. All underdrain pipes shall have a minimum diameter of six inches.

### Sec. 4.2. - Requirements.

An underdrain system is to be used at existing developed areas where limited space and drainage infrastructures exist. Drainage net works for retention/detention basins and swales for new development areas are strongly discouraged. An underdrain system consists of perforated pipe wrapped with filter fabric. The wrapped pipe is embedded in filter aggregate in which stormwater runoff seeps into the pipe for storage, exfiltration and conveyance. Underdrain pipes shall be constructed at a minimum grade of 0.1 percent.

### Sec. 4.3. - Filter fabric.

The filter fabric shall be of strong, tough, porous nylon, polyester, polypropylene, or other fabric which completely covers and secures to the underdrain pipes and aggregate in such a way as to prevent infiltration of trench backfill material. The filter fabric shall be in accordance with FDOT Standard Specifications for Road and Bridge Construction, section 985. All filter fabric joints shall overlap a minimum of one foot.

### Sec. 4.4. - Filter aggregate.

Coarse aggregate shall be used as the inner layer for the filter fabric envelope. The coarse aggregate shall consist of hard, durable, clean quartz gravel of one to one-half inch in size, meeting the requirements of FDOT Standard Specifications for Road and Bridge Construction, section 901-1.4, No. 5. The coarse aggregate for the filter fabric envelope shall be constructed in accordance with FDOT Index 286, type III.

Fine aggregate shall be used as the outer layer around the filter fabric envelope. The fine aggregate shall consist of hard, durable, clean quartz sand, reasonably graded from coarse to fine, meeting the requirements of FDOT Standard Specifications for Road and Bridge Construction, section 902-2. The fine aggregate around the filter fabric envelope shall be constructed in accordance with FDOT Index 286, type III.

#### Sec. 4.5. - Underdrain pipe.

Underdrain pipe shall be of corrugated polyethylene tubing conforming to A.A.S.H.T.O. M-252.

#### Sec. 4.6. - Excavation trench.

The trench shall be excavated to such depth and width as required to permit the pipe to be laid to the grade desired, and to the dimensions shown in the plans.

The underdrain trench shall be constructed in a dry condition.

#### Sec. 4.7. - Placing the filter fabric.

After the trench has been excavated, the filter fabric shall be rolled out over the trench and walked into the trench. Care shall be taken to prevent the excavated material from entering the trench after the fabric has been installed.

#### Sec. 4.8. - Laying the pipe.

After the filter fabric has been placed in the trench, approximately six inches of coarse aggregate shall be placed in the trench. The pipe shall be bedded firmly in the filter aggregate to the correct line and grade. The upper end of the run of pipe shall terminate at a drainage structure or underdrain cleanout to prevent any filter aggregate from entering the pipe.

All lateral connections to underdrains shall be made at approved drainage structures. The maximum spacing of cleanouts or structures shall be 200 feet.

#### Sec. 4.9. - Placing and compacting filter aggregate.

After the pipe has been laid to grade, the pipe shall be firmly held in place by mechanical means while the filter coarse aggregate is placed to a maximum height of six inches (compacted) above the top of the pipe. After the first lift is placed and compacted, the remainder of the filter coarse aggregate shall be placed. The procedures and steps of excavation, filter fabric placement, and aggregate placement and compaction shall be accomplished in a single continuous operation.

#### Sec. 4.10. - Backfill filter fine aggregate.

After the filter coarse aggregate has been placed 12 inches above the pipe, the filter fabric shall be lapped the full width of the trench from both sides to form a filter fabric envelope. The portion of the trench outside the filter fabric envelope shall be filled with filter fine aggregate which shall be placed and tamped in layers to the existing grade.

### SECTION 5. - EROSION AND SEDIMENT CONTROL

#### Sec. 5.1. - Description.

Erosion caused by stormwater runoff on the bare ground surface during land development and construction results in transporting topsoil to the downstream as sediment. The accumulation and deposition of sediment on canal, river, lake, swale or retention/detention basins impairs flow and reduce storage volume and water quality of the receiving water. Erosion and sediment control measures shall be implemented on all land development in the city.

Sec. 5.2. - Requirements.

The erosion and sediment control plans shall be submitted to the city prior to site plan approval. The control plans shall indicate existing and proposed grading, runoff flow and temporary containment, stockpiling material, temporary surface cover, siltation barriers, etc.

Sec. 5.3. - Stockpiling material.

No excavated material shall be stockpiled in such a manner as to direct runoff directly off the construction site or into any adjacent water body or stormwater collection facility.

Sec. 5.4. - Exposed area limitation.

The surface area of open and erodible soil exposed by cleaning and grubbing operations or excavation and filling operations shall be limited to an extent that temporary measures such as mulching can be provided to stabilize the surface soil daily. Exposed and bare land surface for a period of not more than 30 days shall be stabilized with a quick growing grass species which will provide an early cover during the season in which it is planted, and will not later compete with the permanent grassing. The rate of seeding shall be 30 pounds per acre.

Sec. 5.5. - Inlet protection.

Inlets and catch basins shall be protected from sediment laden stormwater runoff during construction phase by installing bailed hay or straw barriers at the entrance in accordance with FDOT Index 102.

Sec. 5.6. - Temporary seeding and mulching.

Land slopes steeper than 6:1 shall additionally receive mulching of approximately two inches loose measure of much material cut into the soil of the seed areas to a depth of four inches.

The seeded or seeded and mulched areas shall be rolled and watered as required to assure optimum growing conditions for the establishment of a good grass cover.

Sec. 5.7. - Permanent seeding and mulching.

All exposed finish surfaces after grading shall be seeded and mulched to achieve the level of protection from erosion. Finish ground slopes from 6:1 to 4:1 inclusive shall be mulched with two inches of loose mulch material cut into the soil of the seeded area to a depth of four inches.

Sec. 5.8. - Permanent sodding.

All retention/detention basins and swales shall be sodded in accordance with sections 1.6 and 2.4 of this manual. Strip sod shall be placed adjacent to all curbs, walks, pavement and inlet structures.

Sec. 5.9. - Turbidity barriers.

All constructions within the vicinity of receiving water, such as canal, river, lake or wetlands, shall install turbidity barriers along the shore of the receiving water. The installation of turbidity barriers shall be in accordance with FDOT Index 103.

Sec. 5.10. - Standard details chain link fence.

A. *Materials.*

*Types of fencing:*

*Chain link.* Install seven-foot high fencing, consisting of six feet of chain link and three strands of barbwire. Specific location of fence construction shall be as shown on the plans.

*Fabric.* Use two-inch mesh, 9 gauge galvanized after weaving, six feet high to form a continuous chain link fabric.

*Barbwire* Use 12 ½ gauge wire with four barbs spaced approximately five inches apart, zinc-coated with a minimum coating of 0.80 ounce per square foot of surface area. Support three strands of barbwire on arms extended one foot above the fence and at a 45-degree angle.

*Zinc coating.* Zinc coat after fabrication all steel and iron parts using zinc grade "E" in accordance with Federal Specifications WW-C-351. Cover each square foot of actual surface with not less than 1.2 ounces of zinc coating.

*Posts, frames and braces:*

*Chain link.* Using posts and frames with the following minimum dimensions and weights:

- a. Line posts - 1.9 inches O.D., 2.72 pounds per foot, 0.145-inch wall thickness.
- b. End, corner, gate and pull posts - 2.875 inches O.D., 5.79 pounds per foot, 0.203-inch wall thickness.
- c. Top rails, bracing and gate frames - 1.66 inches O.D., 2.27 pounds per foot, 0.14-inch wall thickness.

*Stretcher bars.* Minimum three-sixteenths inch by three-quarters inch, and one inch less in length than the full height of fabric.

*Post tops.* Ornamental tops or combination tops and barbwire supporting arms with hole for purpose of top rail of a size to fit over outside of posts to exclude moisture.

*Top rail couplings.* Minimum six inches long.

*Bottom tension wire.* Use a No. 7 gauge galvanized spring coil or crimped wire.

*Concrete.* DOT Spec. paragraphs 345-2, 345-3, 345-4, 345-6, 345-9, 345-10, 345-11, 345-12, and 345-13, except that the word "Department" shall be taken as "Owner." Make all concrete with class 1 concrete, minimum 28-day compressive strength of 2,500 psi.

**B. Installation.**

*Line posts - Chain link.* Uniform space line posts a maximum of ten feet apart.

*Pull posts - Chain link.* Install pull posts as required for proper installation.

*Posts - Chain link.* Do not stretch fabric until concrete has cured a minimum of three days. Set posts plumb. Set all posts at least 33 inches deep into a 36-inch deep by one-foot diameter concrete foundation crowned to shed water.

*Lead gates.* Gate will be six feet wide each leaf of a 12-foot overall width double leaf gate as shown on the drawings and six feet high with three strand barbed wire on top to match fence used. The gate shall be properly trussed to prevent sag using two inches O.D. minimum schedule 40 galvanized pipe. The hardware shall be of adequate design and strength to provide satisfactory operation. Gate shall be capable of being opened and closed easily by one person. Also, there shall be provided a hardware and locking system to be approved by the owner.

*Corner, end, pull and gate posts.* Brace all corner, end, pull and gate posts with 1.6-inch O.D. galvanized steel tubes and fittings in each direction.

*Top grade.* Construct the top of fence to a uniform line or grade to present an even appearance.

*Top rail.* Form a continuous brace from end to end and pass through line posts.

*Bottom tension wire.* Stretch taut between terminal posts and securely fasten to each intermediate post six inches above finished grade. Attach to fabric with galvanized hog rings every 14 inches.

*Ties.* Provide ties or clips of adequate strength in sufficient number for attaching the fabric to all line posts at intervals not exceeding 15 inches. Stretch fabric taut without sag and securely fasten to all posts. Provide one stretcher bar for each gate and end post and two for each corner and pull post. Top rail ties shall be on 24-inch centers.

*Barbed wire.* Install extension arms. Tightly stretch and secure barbed wire to each arm or post as the fence type dictates.

*Grounding.* Install electrical ground at locations and according to details shown on the drawings for all fencing installations where the site is served by overhead electrical service.

*Clearing.* Where the clearing and grubbing for the project does not include the area occupied by the fence, clearing shall be done to the limits shown on the plans. If the limits are not shown on the plans, clearing shall be done to a width of at least two feet on each side of the fence line, except that the engineer/owner may direct that valuable trees be left in place. Such clearing shall not extend beyond the right-of-way or property line.

*Construction over irregular terrain and other obstructions:*

1. *Clearance of bottom of fence.* The bottom of the fence shall, in general, follow the contour of the ground. The fence is detailed in the plans at approximately three inches above ground line. Over irregular ground, however, a minimum clearance of one inch length and a maximum clearance of six inches will be permitted for a length not to exceed eight feet, and for type A fence, with the barbed wire spaced midway between ground and bottom of fabric.
2. *Grading.* Where necessary to secure proper vertical alignment, and to meet the clearance requirements specified above, depressions shall be substantially filled (except where filling would obstruct proper drainage) and knolls and ridges cut down; all in such manner as to provide a substantial and permanent foundation for the fence.
3. *Use of extra-length posts.* At locations where it is impractical to adjust the ground level, the engineer/owner may require that posts of additional length be set and that the opening at the bottom be closed by additional barbed wire, stretched taut between poles, with no vertical distance between wires greater than three inches. For all such posts requiring a concrete base, the concrete shall be extended downward to the bottom of the extra-length post.

#### Sec. 5.11. - Illustrations and drawings.

The illustrative drawings that might be required in this section are on file with the city engineer.

# **CHAPER THREE**

**SPECIFICATIONS OF  
STANDARD UTILITY CONSTRUCTION  
CITY OF EUSTIS  
WATER & WASTEWATER DEPARTMENTS**

## CHAPTER 3 - STANDARD UTILITY CONSTRUCTION SPECIFICATIONS<sup>11</sup>

### PREFACE

The specifications set forth herein provide minimum standards for the construction of water and sewage transmission and collection facilities which meet conditions which follow:

1. Facilities to be constructed within the City of Eustis rights-of-way.
2. Facilities to be turned over to the City of Eustis for operation.
3. Facilities to become a permanent part of City of Eustis utilities system.

These specifications describe the minimum acceptable standards of construction and to promote uniformity where practical. It is felt that adherence to the standards presented in this booklet will benefit both the citizens of Eustis and the operators of the facilities.

Should any design be submitted which varies appreciably from the standards set herein or uses materials other than those recommended, it should be accompanied by appropriate supporting documentation or engineering studies.

All plans submitted for review must be in conformance with all federal, state, county, and city regulations and codes. Minimum standards will not be less than those established by recognized private and governmental agencies, unless stated otherwise in these specifications.

Construction specifications for transportation and stormwater management are listed in Chapter 1 and Chapter 2, respectively.

Footnotes:

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**Editor's note**—Ord. No. 08-14, § 1 adopted July 17, 2008 repealed the former subpt. B, land development regulation, Appendices A—C, and enacted a new subpt. B, land development regulation, Appendices A—C as set out herein. The provisions of the former Appendices A—C derived primarily from Ord. No. 92-18 adopted Aug. 27, 1992, and from subsequent amendatory ordinances.

**Editor's note**—Printed herein are the Standard Utility Construction Specifications, as adopted by Ord. No. 08-14 on July 17, 2008. Amendments to the specifications are indicated by parenthetical history notes following amended provisions. The absence of a history note indicates that the provision remains unchanged from the original ordinance. Obvious misspellings and punctuation errors have been corrected without notation. For stylistic purposes, headings and catchlines have been made uniform and the same system of capitalization, citation to state statutes, and expression of numbers in text as appears in the Code of Ordinances has been used. Additions made for clarity are indicated by brackets.

**Cross reference**— Utilities generally, ch. 94.

### SECTION 1. - BASIC INFORMATION

#### Sec. 1.1. - Authority.

1.11. *Approval.* These design standards are accepted and approved by the city commission.

1.12. *Scope and intent.* The intent of these development procedures is to establish minimum engineering requirements for projects submitted to the city. The development procedures will apply to all development and construction projects, both public and private, within the jurisdiction of the City of Eustis.

1.13. *Variances.* Under extreme conditions with specific applications, the following procedures and policies may be altered to meet certain conditions which are beyond the control of the developer provided

that such deviations or alterations are acceptable to the city. Final decisions concerning such alterations shall be made by the city manager or his designee.

1.14. *Changes to these standards.* Changes to these standards may be made by resolution adopted by the city commission.

Sec. 1.2. - General.

The developer and his engineer shall bear all construction, testing, and inspection costs of the project.

1.21. *Predesign conference.* It is strongly recommended that a predesign conference between the owner, his engineer and the city be held.

1.22. *Plans.*

A) *Submission.*

- 1) All construction plans submitted to the city for review and approval shall bear the seal and signature of the Florida registered professional engineer responsible for the project. The address and telephone number of this person shall be shown along with the signature.
- 2) A digital copy (PDF) and three sets of plans and specifications shall be submitted for approval to the city.

B) *Assembly.*

- 1) *Sheet size.* The standard size sheet for construction plans submitted to the city for approval shall be 24 inches by 36 inches. Worksheets and data sheets used in preliminary design work and reviews are not limited to any size, except that which is convenient to handle.
- 2) *Items of construction required.* The developer shall provide as appropriate water and sanitary sewers, and all other necessary improvements in accordance with city specifications, standards and policies.

C) *Utility coordination.* It shall be up to the developer to coordinate all utilities within his development.

D) *City standards and specifications.* Copies of city standards and specifications may be obtained from the city for the cost of reproduction.

1.23. *Permits.* The developer and his engineer are responsible for obtaining and submitting the required design and construction permits to the city and certifying the placement of the utilities into service from the Florida Department of Environmental Protection.

1.24. *Construction.*

A) *Start.*

- 1) *Notification.* The city shall be notified in writing of the proposed date of the beginning of construction of the water and sanitary sewer facilities. Any time that work is to stop for a period of time in excess of two working days, the city shall be notified of such interruption.
- 2) *Preconstruction conference.* A preconstruction conference shall be held at least two days before the commencement of construction. A 100 percent payment and performance bond shall also be provided. The developer shall be responsible for arranging this conference with the city.

B) *Completion.*

- 1) *As-built drawings.* Within two weeks following final inspection, the developer shall submit a digital copy (PDF and CAD format) and three white-background prints of as-built drawings to the city. These drawings shall be signed by a registered engineer attesting that the accuracy of the facilities shown on the drawings are, in fact, correct.
- 2) *Certificates of compliance.* Certificates of compliance with the specifications furnished by the material supplier shall be submitted on all materials used in the completion of this work.

- C) *Off-site pollution protection.* It will be the developer's responsibility to provide downstream siltation protection during construction. In the event such protection is inadequate, it will be the developer's responsibility to remove any downstream siltation prior to the time of final inspection.

1.25. Inspection.

- A) *Periodic.* The city will periodically visit the project site to make a visual inspection of the progress of the work and methods of construction.

Upon observation of work not done in accordance with the plans and specifications, the city will notify the developer's contractor and request that necessary corrections be made or tests performed to assure compliance with the specifications, at no cost to the city.

- B) *Final.* The city shall be notified in writing when the project is complete. Upon receiving a written request for final inspection of the completed work, the representatives of the city, together with the representatives of other interested agencies, shall perform the final inspection within two weeks of the receipt of the request.

1.26. *Maintenance.* All items or systems must be designed in such a manner to minimize future maintenance. A two-year maintenance bond (20 percent) of approved construction cost shall be furnished to the city at the time of final acceptance along with all warranties and manufacturers' manuals for all items to be maintained by the city. All disturbed earthen areas shall be grassed and mulched or sodded prior to acceptance. The city shall be provided five-year warranties on all pumps, motors, electrical panels, etc., by the contractor prior to final acceptance by the city.

1.27. *Transfer of private ownership.* When transfer of private facilities to public ownership takes place, all such private facilities shall be brought up to the current city standards at no cost to the city insofar as construction and maintenance are concerned, before the city will accept such facilities. The city is to be furnished copies of all approvals, permits, certificates of completion, etc., to or from completion, etc., to or from other agencies such as Lake County, Florida Department of Environmental Protection, St. Johns River Water Management District, Florida Department of Transportation, railroads, etc., before proceeding with construction. Proof of satisfactory completion of water and sewer facilities, positive water bacteriological tests, and submission of quick claim [quit claim] deeds, bills of sale, prior and current permits, warranties, manufacturers' manuals, and a 20 percent two-year maintenance bond shall be furnished to the city prior to acceptance.

1.28. *Property ownership.* All facilities to be owned or maintained by the city shall be located on city property, within city right-of-way or on easements dedicated to the city for the uses intended.

1.29. *Time period of approved plans.* Plans shall be valid for construction for a period of one year from the date of city approval only. All items not under construction within one year of the approval date shall require a new approval prior to the commencement of construction.

## SECTION 2. - UTILITY EXCAVATION, TRENCHING, AND BACKFILLING

### Sec. 2.1. - General.

The provisions set forth in this section shall be applicable to all underground sewer and water piping installations, regardless of location, unless prior approval is received from the city for special design consideration.

### Sec. 2.2. - Materials.

#### 2.21. *Sheeting and bracing.*

- A) Wood sheeting to be left in place shall be pressure treated.
- B) Steel sheeting to be left in place shall be as specified in ASTM Designation A328.

Sec. 2.3. - Workmanship.

2.31. *Trench dimensions.* The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus eight inches for unsheeted trench, or 12 inches for sheeted trench; and the maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus two feet, unless otherwise shown on the drawing details, or approved by the city.

2.32. *Utility bedding.*

- A) *Class B (minimum utility bedding).* The bottom of the trench shall be shaped to provide a firm bedding for the pipe. The pipe shall be firmly bedded in undisturbed soil, or hand shaped so that the pipe will be in continuous contact therewith for its full length.
- B) *Class A (special utility bedding).* Should special bedding be required due to depth of cover, impact loadings, or other conditions, class A bedding methods shall receive prior approval by the city.

2.33. *Unsuitable material below trench grade.* Soil unsuitable for a proper foundation encountered at or below 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 suitable foundation material, unless special design considerations received prior approval from the city. Backfilling below trench grade shall be in compliance with the applicable provisions of section 2.41, "Backfill."

2.34. *Extra utility-bedding material.* When rock or other noncushioning material is encountered at trench grade, excavation shall be extended to six inches below the outside of the bottom of the utility, and a cushion of sand or suitable crushed rock shall be provided.

2.35. *Sheeting and bracing.* In order to prevent damage to property, injury to persons, erosion, cave-ins, or excessive trench widths, adequate sheeting and bracing shall be provided in accordance with standard practice and in accordance with all safety, protection of property, and other applicable laws and regulations.

2.36. *Excavated material.* Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the contractor shall be responsible for obtaining the sites to be used.

2.37. *Material disposal.* Excess, unsuitable, or cleared or grubbed material resulting from the utility installation, shall be removed from the work site and disposed of at locations secured by the contractor. Excess excavated material shall be spread on the disposal site and graded in a manner to drain properly and not disturb existing drainage conditions.

2.38. *Borrow.* Should there be insufficient satisfactory material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured by the contractor.

2.39. *Dewatering.* Utilities shall be laid "in the dry" unless otherwise approved. Dewatering systems shall be utilized in accordance with good standard practice and must be efficient enough to lower the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry.

2.40. *Obstructions.* It shall be the contractor's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. 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 service rendered by the facility disturbed.

2.41. *Backfill.*

- A) Backfill material shall be clean earth fill composed of sand, clay and sand, sand and rock, crushed rock or an approved combination thereof.
- B) When trenches are cut in pavements or areas to be paved, compaction as determined by AASHTO Specification T-180, shall be, for each six-inch backfill lift, equal to 98 percent of maximum density, with compaction in other areas, with prior city or coordinating agency approval,

not less than 90 percent of maximum density. Density tests shall be provided for trenches within pavement or across roads.

Backfilling of pipe trench or under and around structures shall be, for each 12-inch backfill lift, compacted to 95 percent of maximum density as determined by AASHTO T-180.

One compaction test shall be carried out for each 300 linear feet of pipe and for every 100 square feet of backfill under and around structures and pavement as a minimum.

- C) If, in the opinion of the city, densities are questionable, density tests for determination of the above specified (section 2.41) compaction shall be made by a testing laboratory approved by the city at the expense of the contractor. Test locations will be determined by the city.
- D) If any test results are unsatisfactory, the contractor shall reexcavate and recompact the backfill at his expense until the desired compaction is obtained.
- E) Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed pipe against excessive loads across roadways and river/swamp areas.
- F) Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired by the contractor at his expense.
- G) All water and sewer lines must have a metallic tape trace placed twelve to sixteen inches above the crown of the pipe.H) All water, reuse and sewer force mains must have a #10 copper wire strapped to the piping and pulled up into all valve boxes and all meter boxes.

#### 2.42. *Roadway and pavement restoration.*

- A) 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. The contractor shall obtain the necessary permits and all applicable authorizations from the proper agencies prior to any roadway work. Additionally, the contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.
- B) Restoration shall be in accordance with requirements set forth by the city. The materials of construction and method of installation, along with the proposed restoration design for items not referred to or specified herein, shall receive prior approval from the city.
- C) Where existing pavement is removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
- D) 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.
- E) Density tests shall be provided for trenches in pavement across roadways as specified in section 2.41.

2.43. *Protection and restoration of property.* 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 repair thereof.

2.44. *Cleanup.* Work site cleanup and property restoration shall follow behind construction operations without delay.

### SECTION 3. - BORING AND JACKING / DIRECTIONAL BORING

Sec. 3.1. - General. (Boring and Jacking)

- A) The provisions of the section shall be the minimum standards for the installation of casing pipe by the boring and jacking method for placement of sewer and water pipelines.
- B) In general, all underground pipelines crossing existing major city roadways, Florida state highways, and railroads shall be installed under these traffic ways within bored and jacked steel casing pipe. Specific crossing requirements shall be obtained in advance from authority having jurisdiction.
- C) It shall be the responsibility of the contractor to submit the necessary permit documents and data to the appropriate authority and receive approval thereof.

Sec. 3.2. - Materials and installation. (Boring and Jacking)

3.21. *Dimensions and materials.* Casing pipes crossing under city roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum 36 inches depth of cover between the top of the casing pipe and surface of the roadway where practicable. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139, grade B. The minimum casing pipe size and wall thickness shall be as shown in the following table for the sewer and water carrier pipe size indicated.

Carrier Pipe (Nominal Size- Inches)	Casing Pipe (Outside Diameter- Inches)	Casing Pipe (Wall Thickness- Inches)
4	12	0.250
6	14	0.250
8	16	0.250
10	18	0.250
12	20	0.250
14	22	0.250
16	24	0.250
18	28	0.375
20	30	0.375
24	34	0.375

3.22. *Areas not under jurisdiction.* For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the city, the contractor shall comply with the regulations of said authority in regard to design, specifications and construction. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified under paragraph 3.21 preceding.

3.23. *Workmanship.*

- A) The boring and jacking operations shall be done simultaneously with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring butt welded to the preceding length, developing watertight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, masonry or bituminous plugs are to be installed at each open end.
- B) 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 pipe casing to preclude formation of voids outside of the pipe shell.
- C) The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressure.
- D) Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced and dewatered as required.

The distance between the edges of the jacking pit and the pavement is six feet minimum.

- E) The carrier pipe shall be minimum class 50 ductile iron pipe with restrained joints. The carrier pipes shall be supported by wooden skids within the casing pipe.

Sec. 3.3. - General. (Directional Boring)

- A) This section covers installation of polyethylene and PVC pressure pipe using directional boring techniques.
- B) Directional bores shall be completed per the requirements of this Chapter and any entity having jurisdiction over the area of the work. Sec. 3.4. – Pipe Material. (Directional Boring)

3.41. *Pipe.* For water and reuse mains two inches and under, the pipe shall be high density polyethylene (HDPE) tubing conforming to AWWA C901, in the sizes shown on the PLANS. HDPE tubing classification shall be DR9, ductile iron pipe inside diameter with potable or reuse water identification. Fusible PVC or Certainteed Certa-lok conforming to AWWA C900 and C905 shall be allowed for directional bores of all water, reuse, and wastewater main above two inches.

3.42. *Adapters.* Provide adapters on lines over 2" suitable for connection to DIP or PVC pipe. These shall be butt-fused mechanical joint end only.

3.43. *Certification.* All pipe shall be accompanied by manufacturer's certification that the pipe meets all specified standards, with an enumeration of each parameter specified herein and such other parameters as required by the permitting authority.

3.43. *Tracer Wire.* Tracer wire for directional bores shall be 10 gauge steel core copper or equal.

Sec. 3.5. – Pipe Handling. (Directional Boring)

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

#### Sec. 3.5. – Construction Requirements. (Directional Boring)

The pipe shall be installed to the exact lines and grades required. The type and size of the pilot string cutting head shall be at the contractor's discretion. The type and outside diameter of the drill pipe to be used in the pilot string shall also be at the contractor's discretion. The method of guidance utilized in locating and steering the pilot string from entry to exit shall be controlled in both vertical and horizontal directions. Readings shall be recorded after the advancement of each successive drill pipe and the readings plotted at a minimum of 5 foot intervals. Recorded readings and plan profile information shall be submitted to the engineer and the city. All directional bore design depths shall be reviewed and approved by the city prior to commencing work. Lateral position at exit shall be no further than 3 feet left or right of planned centerline and horizontal positioning shall be no further than 5 feet short or long of proposed exit location. Entry and exit locations, as well as intermediate centerline stationing shall be staked by the contractor. This information shall be shown on the record drawings. Upon completion, a complete set of as-built records shall be submitted in duplicate to the engineer and the city. These records shall include copies of the plan and profile drawing, as well as directional readings recorded during the drilling operation. Upon approval of the pilot hole location by the engineer and the city, the hole enlarging or back reaming phase of the installation shall begin. The borehole diameter shall be increased to accommodate the pullback operation of the pipe. The type of back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the contractor's discretion with the final hole diameter being a minimum of forty percent larger than the outside diameter of the product pipe being installed in the borehole. The open borehole may be stabilized by means of Bentonite drilling slurry being pumped through the inside diameter of the drill pipe and through openings in the reamer. The slurry shall also serve as an agent to carry the loose cuttings to the surface through the annulus of the borehole. These cuttings and Bentonite slurry are to be contained at the exit hole or entry side of the directional bore in pits or holding tanks. The slurry maybe recycled at this time for the reuse in the hole opening operation or it shall be hauled by the contractor to an approved dumpsite and properly disposed of. A complete list of all drilling fluid additives and mixtures to be used in the directional operation shall be submitted to the engineer and the city along with their respective Material Safety Data Sheets. All drilling fluids and loose cuttings shall be contained; no fluids shall be allowed to enter any unapproved area or natural waterways. Upon completion of the directional drill project, all excess drilling fluid and cuttings shall be removed by the contractor. After installation, the line shall be pigged. A pressure test shall be performed after installation in the borehole. The pre-installation test pressure is at the contractor's discretion. After installation, the pipe shall be pressure tested in accordance with city standards. Heat fusion joints shall be completely cooled before pressure testing. The manufacturer's recommendations on pipe stretch, pull strength, and allowances shall be observed.

### SECTION 4. - PIPE, FITTINGS, VALVES AND APPURTENANCES

#### Sec. 4.1. - General.

- A) This section includes the material and installation standards for pipe, fittings, valves, and appurtenances, as applicable to sewerage, reuse and water installations.
- B) Required specialty items not included under this section shall be high quality and consistent with approved standards of the industry for the applicable service installation.
- C) All material to be furnished by contractor or developer, with exception of meters and meter couplings.

#### Sec. 4.2. - Pipe and fittings.

4.21. *General.* All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer. All pipe and fittings shall be suitable for 200 psi working pressure. All pipe installations shall have indicator tape run with pipe to indicate the purpose of piping (water, reuse, sewer, force main).

4.22. *Ductile iron pipe.*

- A) Ductile iron pipe shall be in accordance with ANSI Standard A21.51. Pipe shall be laid in accordance with ANSI Standard A21.50. Thickness class shall be governed by design conditions; minimum thickness class shall be 50 mils.
- B) Cast and ductile iron pipe fittings shall conform to ANSI Standard A21.10.
- C) *Joints:*
  - 1) "Push-On" and mechanical type joints shall be in accordance with ANSI Standard A21.11.
  - 2) Restrained joint assemblies with mechanical joint pipe shall be mechanical joint retainer glands "locked-type" joints of Megalug or approved equal.
  - 3) Flanged connections shall be in accordance with ANSI Standard B16.1, 125-pound standard.
  - 4) No leaded joints or connection of any kind will be permitted.
  - 5) PVC fittings prohibited above three inches in diameter, unless otherwise specifically approved by the city.
- D) *Coatings and linings:*
  - 1) Ductile iron pipe and fittings for force mains or when used as gravity sewer service shall receive an interior epoxy lining of 40 mils nominal, 35 mils minimum for both pipe and fittings.
  - 2) Ductile iron pipe and fittings for water service shall receive an exterior bituminous coating as specified above under Paragraph 1 and shall be cement mortar lined in accordance with ANSI Standard A21.4.

4.23. *Polyvinyl Chloride (PVC).*

- A) Pipe shall be manufactured from clean virgin type I, grade I, rigid, unplasticized polyvinyl chloride resin conforming to ASTM Designation D1784 and AWWA Standard C900. Pipe material shall conform to ASTM Designation D1785. The pipe shall bear the National Sanitation Foundation (NSF) seal for potable water pipe. Pipe shall have a minimum standard dimension ratio (SDR) of 18, 150 psi for water and SDR 25, 100 psi for sewer force mains. A minimum SDR of 35 (ASTM 3034) for gravity sewer mains will be required.
- B) Connections for pipe two inches in diameter and larger shall be rubber compression ring type. Pipe shall be extruded with integral thickened wall bells without increase in SDR. Rubber ring gaskets shall consist of synthetic compounds meeting the requirements of ASTM Designation D1869, and suitable for the designated service. Other connections for pipe shall be solvent welded sleeve type joint. Fittings for two-inch and smaller pipe shall be PVC solvent welded joints. Fittings for use with PVC pipe (water lines or sewage force mains) will be cast iron or ductile iron with mechanical joint rubber compression ring type joints. For all pipe three inches and larger, no PVC fitting will be allowed except on pipe and fittings smaller than three inches.
- C) All nonmetallic piping (PVC, polyethylene tubing) shall have a #10 copper armored polyguard wire that strap and run with the pipe.

4.24. *Polyethylene plastic pipe.* Pipe or tubing shall comply with AWWA C800 and AWWA C901 and be approved for potable water service by the National Sanitation Foundation and bear the NSF seal. The product shall be rated for a minimum working pressure of 200 psi. Fittings shall be brass, equipped with compression type connections.

4.25. *Copper pipe and tubing.* Pipe or tubing shall meet AWWA C800. Fittings shall be brass, with approved compression connections.

4.26. *Special items.*

- A) Tapping saddles shall be of two types:
  - 1) Stainless steel full circle sleeve as manufactured by Ro-Mac type SST, assuring a full circumferential seal, or approved equal.
  - 2) Mechanical joint type with outlet, flange ANSI B16.1, 125 lb. standard, Mueller #615 or #715, assuring a full circumferential seal, or approved equal.
- B) Service saddles shall be as manufactured by Smith & Blair, Inc., or approved equal. Units for ductile iron, PVC, or cement pipe shall be double strap. Sealing gasket shall be BUNA-N rubber and straps shall be corrosion resistant stainless steel or equivalent alloy steel.

Sec. 4.3. - Valves.

4.31. *General.* The valve type, size, rating, flow direction arrow, if applicable, and manufacturer shall be clearly marked on each unit. Valves shall open left (counterclockwise) with an arrow cast in the metal of operation hand wheels and nuts indicating the direction of opening.

- A) *Valves for underground service.* Valves from two inches thru 12 inches for underground service shall be iron body gate valves, nonrising stem type and shall be equipped with a two-inch square cast iron operating nut with corrosion protection coating inside and out, resilient seated valve which meets all C509 requirements of AWWA (water and sewer), Mueller A2370-20, American-Flow Control CRS-80, or approved equal. Valves 12 inches and larger for underground service, shall be iron body gate valves, bronze mounted, conforming to AWWA C500, solid wedge double disc (water or sewer) non-rising stem type, and shall be equipped with two-inch square cast iron operating nut, Mueller #2380-20, American-Flow Control Model #55, or approved equal. All dead-end lines will have valves at end the size of main line pipe with blow off attached. End line valves shall be adequately restrained to the pipeline such that they may be excavated and the line extended without shutting off line pressure.
- B) *Valves for aboveground service for fire systems only.* Valves shall be iron body, bronze mounted gate valves, conforming to AWWA C500, solid wedge (sewage) or double disc (water) with the exception that valves shall be outside screw and yoke (OS & Y) rising stem type. Valves shall have cast iron hand wheels or chain operators with galvanized steel chains, as required. Valves for fire suppression system shall be approved by city fire officials and a detector valve may be required.
- C) *Valves smaller than two inches.* Valves smaller than two inches shall be bronze body gate valve conforming to federal specifications 150 psi minimum working pressure with threaded joints equal to American 3 FG or Red and White 280. The use of this type of valve would have to be approved by the city.

4.32. *Backflow devices.*

- A) Double check valve assembly shall be designed to specification of the USC Cross Connection Control Laboratory, AWWA C506 and A.S.S.E. #1015.

Double check valves shall be Hersey Model FDC for three-fourths-inch through two-inch and Model #2 for 2 ½-inch thru ten-inch, Watts #709 series three-fourths-inch thru ten-inch, or approved equal. Double check valve assembly from 2 ½ inch and up shall be furnished with OS & Y gate valve shutoffs.

- B) Reduced pressure zone valve shall be designed to specification of the USC Cross Connection Control Laboratory, AWWA C506 and A.S.S.E. #1013. Reduced pressure zone valve shall be Hersey Model FRP-II for sizes three-fourths-inch through two-inch and Model #6CM for sizes 2 ½-inch through ten-inch, Watts Series 909 for sizes three-fourths-inch through ten-inch, or approved equal. Reduced pressure zone valve assembly from 2 ½ inches and up shall be furnished with OS & Y gate valve shutoffs.

- C) Pressure vacuum breaker shall be designed to specification of USC Cross Connection Control Laboratory, A.S.S.E. #1020. Spring loaded single float and disc with independent water inlet and air inlet valves, furnished with shutoff valves and ball type test cocks. Pressure vacuum breaker shall be Watts #800, Febco #765, or approved equal.
- D) Shutoff valves on backflow assembly for sizes three-fourths inch through two inches shall be provided with ball valves, assemblies above two inches shall be provided with resilient seat full flow gate valves.

4.33. *Check valves.* Valves for wastewater application shall be iron body, bronze mounted stainless steel hinge pin, outside lever and spring operated, swing type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe; Mueller #2600-6-02, or approved equal.

4.34. *Plug valves (PV).* Valves for wastewater application shall be semisteel body, nonlubricated, eccentric type, with resilient faced plugs, and capable of driptight shutoff at the rated pressure if applied at either port. Operation of all valves eight inches or larger, and smaller sizes in exposed locations which require handwheels or chainwheels, shall be by approved gear actuators, equipped with position indicator and stop, and shall be furnished by the valve manufacturer. Gear actuators for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron handwheels or chain operators, with galvanized steel chains, as appropriate for the installation and type of operator. Valves and appurtenances shall be Series 100, as manufactured by DeZurik Corp., or approved equal.

4.35. *Butterfly valves.* Valves shall be cast iron body, self-lubricated, rubber seated, one-piece stainless steel shaft, and capable of drip-tight shut-off at the rated pressure and meet AWWA C504. Valve operators shall conform to AWWA C504. Valve operator for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron handwheels or chain operator as appropriate for the installation and type of operator. Valves shall be installed in a vertical position. Valves and appurtenances shall be DeZurik, Series 130, American-Darling 150, or approved equal.

4.36. *Valve boxes.* Units shall be adjustable, cast iron, minimum interior diameter of five inches, with covers cast with the applicable inscription in legible lettering on the top; "SEWER" or "WATER". Boxes shall be suitable for the applicable surface loading and valve size. Valve boxes not in the pavement shall have the top concrete pads flush with the finish grade, with minimum dimensions of 24 inches by 24 inches by six inches.

4.37. *Meter boxes.* Boxes shall be of concrete construction as manufactured by DFW model DFW37F, DFW1730C, or approved equal.

4.38. *Fire hydrants.* Fire hydrants shall be of Mueller Super Centurian 200 oil reservoir, American-Flow Control six-inch B-84-B, Kennedy Guardian #K-81A or approved equal. See section 8.32 for details.

4.39. *Service line.* Service lines shall be one inch for single and 1 ½ inches with one inch branch off for double service. All fittings shall be Mueller or Ford brass. Curb stops to be Mueller #15317 or Ford #FB41-344W. Corporation stops to be Mueller #H-15008 or Ford #F 1000.

#### Sec. 4.4. - Installation.

##### 4.41. *General requirements.*

- A) Piping, fittings, valves and appurtenances shall be installed in accordance with these standards.
- B) Piping shall be installed along straight line and grade between fittings, manholes, or other defined points, unless definite lines of alignment, deflection or grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the city and all resulting design considerations shall be resolved by the contractor.

- C) Materials shall be cleaned and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris, and when work is not in progress, all open ends shall be plugged.
- D) Pipe, valves, fittings, or other items shall be inspected prior to installation, and any items showing a fracture or other defect shall be rejected. However, a cast or ductile iron pipe showing an end crack, with no fracture indicated beyond that visible, may be salvaged by cutting off the damaged section 12 inches past, providing the remaining pipe is sound.
- E) Underground piping shall not be driven to grade by striking it with an unyielding object. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the pipe in correct alignment. If necessary, precaution should be taken to prevent flotation.
- F) Jointing shall be by an approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point.
- G) Underground pressure piping systems shall be thoroughly restrained by mechanical joint ductile iron fitting conforming to ANSI/AWWA A21.11/C111 manufactured by Sigma or approved equal.
- H) Subaqueous pipe laying may be permitted where conditions make it impractical to lay pipe in the "dry", provided the contractor submits his plans for laying pipe under water to the city and obtains advance approval thereof.
- I) Ductile iron pipe is required at all street crossings, ditch, stream or swamp crossings, culvert crossings or with bore and jack crossings.
- J) Disinfecting of all potable water pipes shall be accomplished by the contractor following approved pressure testing. Unless alternate procedures are set forth under the applicable service Standard, said disinfecting procedures shall be in accordance with AWWA Standard C601.
- K) Cast and ductile iron pipe (CI & DI) installation shall be performed in accordance with the applicable provisions of AWWA Standard C600.
- L) Polyvinyl chloride (PVC) pipe-lubrication and/or solvent for pipe and fitting joints shall be nontoxic (NSF approved for potable water). Following making, solvent type joints shall not be disturbed for five minutes and shall not have internal pressure applied for 24 hours, or as recommended by the pipe manufacturer.

## SECTION 5. - SANITARY GRAVITY SEWERS

### Sec. 5.1. - General.

This section includes general technical criteria for the construction and installation of sanitary gravity sewer systems.

### Sec. 5.2. - Design standards.

The developer shall comply with the applicable requirements specified within WPCF Manual of Practice No. 9, and chapter 20 of the Ten-State Standards-Recommended Standards for Sewage Works and as established by the Florida Department of Environmental Protection, and subsection 5.3 of this section.

### Sec. 5.3. - Standard requirements.

5.31. *General.* The materials of construction and general installation procedures shall comply with the specific applicable standards set forth under section 2, "Utility Excavation, Trenching and Backfilling";

section 3, "Boring and Jacking / Directional Boring"; and section 4, "Pipe Fittings, Valves and Appurtenances."

5.32. *Manholes.*

- A) *Manholes shall be precast concrete.* The minimum inside diameter of manholes shall be 48 inches for sewer sized to 21 inches in diameter or less, with submittal of special designs for larger pipes. Manholes are to be placed at the ends of jack and borings section for gravity sewer lines.
- B) Precast reinforced manholes shall be in accordance with ASTM Designation C478, with performed flexible plastic joint sealer conforming to Federal Specification SS-S-0210 (GSA-FSS), "Ram-Nek", as manufactured by the K.T. Snyder Co., Inc., Houston, Texas, or approved equal.
- C) Manholes are generally to be located in dedicated right-of-way or utility easement.
- D) Manhole frames and covers shall be gray cast iron conforming to ASSTM Designation A48, class 30, and shall have a minimum 24-inch opening. Covers shall have no perforations and shall be marked with the word "Sewer." Frames and covers shall be fully bedded in mortar to the correct finish grade elevation, with adjustment brick courses placed below, as detailed for precast manholes. There will be no steps allowed in manholes.
- E) Manhole flow channels shall have smooth and carefully shaped bottoms, built up sides and benching constructed from concrete. Channels shall conform to the dimensions of the adjacent pipe and provide changes in size, grade and alignment evenly.
- F) The interior surfaces of all manholes shall be protected by the application of two coats of Koppers Bitumastic No. 300M, or approved equal. Exterior surfaces shall receive two coats of Koppers Bitumastic Black Solution, or approved equal.
- G) Sewer cleanouts not in the pavement shall have around their tops concrete pads, which will be flush with the top of the curb, with minimum dimensions of 18 to 18 by three inches.
- H) Manholes shall not be located in drainage swales or any other low area likely to collect or pond water during rains.

5.33. *Pipe depth and protection.* The minimum allowable cover for gravity sewers shall be three feet from the top of the pipe to finish grade.

5.34. *Pipe bedding.* Special care shall be exercised in the design and installation to provide adequate bedding for the type of pipe used, taking into consideration trench width and depth, superimposed loadings above grade and the material below trench grade. Pipe loadings capabilities shall be computed in accordance with established design criteria and special supporting bedding or facilities shall be provided as required.

5.35. *Connections at structures.* Where sanitary sewers connect to structures, pipe joint bell shall not be installed at the wall face. Core bore into the existing manholes and use Kor-N-Seal flexible connectors or approved equal with stainless steel straps on all pipe to manhole connectors.

5.36. *Transition connections.* Where pipes of alternate materials are to be connected between manholes, suitable approved transition couplings shall be installed.

5.37. *Pipe cutting.* The cutting of pipe shall be performed by the proper tools and methods.

- A) *Service connections.* Installation shall be performed by the proper methods, including the wye branches installed in the sewer main at the point of connection, and the service pipe and required fittings extended to the property line, perpendicular to said line, terminating with stoppered ends or fittings. The minimum service pipe size shall be six inches in diameter and may provide for single or double connections. On curbed streets, the exact location for each installed service shall be marked by etching or cutting as "S" in the concrete curb and painted red. Where no curb exists or is planned, locations shall be adequately marked by a method approved by the city.
- B) *Protection of water systems.* The horizontal separation between sanitary sewers and existing or proposed water mains shall not be less than ten feet. Special considerations will be given where

this is not possible. Unless sewer pipes cross below water mains with a vertical separation of 18 inches between the bottom of the water pipe and the top of the sewer, special protection shall be provided.

#### Sec. 5.4. - Testing.

- A) The contractor shall perform testing of all sanitary gravity sewers, as set forth in the following and shall conduct said tests in the presence of representatives from the city and/or other authorized agencies with 48 hours' advance notice provided.
- B) Sanitary sewers to be tested shall be within sections. Testing shall not proceed until all facilities are in place and concrete cured. All piping shall be thoroughly cleaned prior to testing to clear the lines of all foreign matter.
- C) Infiltration shall not exceed 300 gallons per day per inch of diameter per mile as measured between manholes. Testing shall proceed for a continuous period of two hours, with infiltration amounts measured by methods approved by the water and wastewater departments.
- D) Should any test fail necessary repairs shall be accomplished by the contractor, and the test repeated until the established limits. Any repairs shall be performed under the supervision of the city forces and by methods receiving prior approval by the city.
- E) If during final inspection the city has reason to doubt the integrity of the sewer lines due to infiltration or poor line alignment, the city may require internal inspection (televising) of the sewer lines at the expense of the developer.
- F) As built plans to be furnished to the city upon completion of project, with actual linear measurements from permanent points to all sewer systems components, including location of each house lateral.

#### SECTION 6. - SANITARY SEWAGE FORCE MAIN

##### Sec. 6.1. - General.

- A) This section includes the general requirements for construction and installation of force main systems serving sanitary sewage pumping stations.
- B) The relevant provisions of other sections of this specification shall be applicable to this section unless otherwise indicated herein or approved by the city.

##### Sec. 6.2. - Design standards.

The developer shall comply with the applicable criteria set forth in WPCF Manual of Practice No. 9, and the department of environmental protection requirements. Additionally, ASCE publication Pipeline Design for Water and Wastewater may be used as a design guide, and subsection 5300 of this manual.

##### Sec. 6.3. - Standard requirements.

6.31. *General.* The materials of construction and general installation procedures shall comply with the specific applicable standards set forth under section 2, "Utility Excavation, Trenching and Backfilling"; section 3, "Boring and Jacking / Directional Boring"; and section 4, "Pipe, Fittings, Valves and Appurtenances."

6.32. *Joint restraining.* Pressure piping fittings and other items requiring restraint shall be braced with mechanical joint ductile iron fittings as required by design. Restraining devices shall be designed for the maximum pressure condition (testing) and the safe bearing loads for the horizontal thrust, if thrust blocking is used.

6.33. *Pipe depth and protection.* The standard minimum cover for sewage force main systems shall be 36 inches from the top of the pipe to finish grade. Where this condition cannot be met, special consideration will be given. Additional depth may be required where future surface improvements are planned or anticipated.

6.34. *Air and vacuum venting.* Where the force main profile is such that air pockets or entrapment could occur resulting in flow blockage, provisions for air release and/or venting shall be provided. Where free flow will occur during operation or after pumping stops, combined air release and vacuum valve assemblies shall be provided.

6.35. *Valve locations.* Valves shall be installed on all subsidiary force mains at the point of connection to the major main and where force mains are to be extended. At future connection branches or ends, the valves shall be restrained by methods other than thrust blocking in order to facilitate said connection without system shut down.

6.36. *Branch connections.* Tee fitting connections are acceptable provided the connection is adequately blocked or otherwise restrained.

6.37. *Cleanout connections.* Should force mains appear to be susceptible to sedimentation clogging, as created by depressed crossings or extended low flow (velocity) periods, suitable clean out connections shall be provided.

6.38. *Terminal discharge.* Force mains shall enter the terminal facility (gravity sewer manhole, pumping station wet well, or other) at a point equal to the operational water level of said receiving unit. Should an elevation drop be required to obtain the outlet connection, the prior downslope of the force main shall not exceed 45 degrees, and adequate air venting shall be provided at the profile breakpoint.

6.39. *Identification.* In order to preclude possible domestic water tapping, all installed underground sanitary sewage force mains shall be marked according to the 10 State Standards.

Sec. 6.4. - Testing.

6.41. The contractor shall perform hydrostatic testing of all sanitary sewage force mains, as set forth in the following, and shall conduct said tests in the presence of representatives from the city and/or other authorized agencies with 48 hours advance notice provided.

6.42. Piping and appurtenances to be tested shall be within sections between valves or adequate plugs, not exceeding 2,000 feet with prior approval from the city. Testing shall not proceed until concrete trust blocks are in place and cured, or other restraining devices installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

6.43. Hydrostatic testing shall be performed at 100 psi for all sizes of force mains. The testing procedure shall continue for an uninterrupted period of not less than two hours. Testing shall be in accordance with the applicable provisions as set forth in section 13 of AWWA Standard C600. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

DIP:			PVC:		
L(DIP)	=	$\frac{S D (P)^{1/2}}{133,200}$	L(PVC)	=	$\frac{N D (P)^{1/2}}{7,400}$

L	=	allowable leakage in gallons per hour
N	=	number of joints
S	=	length of pipe tested in feet
D	=	nominal diameter of the pipe in inches
P	=	average test pressure maintained during the leakage test in pounds per square inch gauge.
(Note: Leakage for PVC on L(DIP), use 0.9 L(DIP))		

- A) The testing procedure shall include the continued application of the specified pressure to the test system, for the two-hour period by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.
- B) Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until within the established limits. The contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required sanitary sewage force main testing and shall perform the necessary system repairs required to comply with the specified hydrostatic test.

**SECTION 7. - SEWAGE PUMPING STATIONS**

**Sec. 7.1. - General.**

7.11. This section includes the general requirements for the design criteria and installation of sewage pumping stations.

7.12. The relevant provisions included in these specifications shall be applicable to this section, unless otherwise indicated herein or approved by the city.

**Sec. 7.2. - Design standards.**

The developer shall comply with the applicable regulations established by the Florida Department of Environmental Protection. Additionally, the criteria provided in chapter 30, "Sewage Pumping Stations," of the "Ten-State Standards-Recommended Standards for Sewage Works," and WPCF Manual of Practice No. 9, may generally be utilized as design guidelines, and section 5.3 of this section, if not in conflict with state, county, or other regulatory agency requirements. See typical submersible lift station design drawing, attached [at the end of this section and is on file with the city engineer].

**Sec. 7.3. - Standard requirements.**

7.31. *Station water system (nonpotable).* All sewage pumping stations shall be provided with a station water system, with adequate capacity and pressure, for wash-down or other requirements. Said supply shall be completely separated from the potable supply by use of reduced pressure type backflow preventers

or other city-approved protective systems. Public Access Reuse shall take precedence over potable water, if available. See attached Backflow prevention assembly at end of the section.

7.32. *Emergency pump connections.* Sewage pumping stations shall be equipped with stationary standby power generator plug sizing is identified in paragraph C).1(c) & (d) below, unless otherwise approved by the city.

7.33. *Sewage pumps, motors, and standby generators.*

- A) *[Sewage pumping units.]* Sewage pumping units shall be capable of handling raw, unscreened sewage and shall be capable of passing a sphere of at least three inches in diameter. Pumps shall be electric motor driven and of a proven design that has been in sewage service under similar conditions for at least five years. Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation. See drawing [which is on file with the city engineer].
- B) *Pump motors.* Pump motors should be nonoverloading, excluding service factor, throughout the entire operating range of the pumps. Two or more normally closed heat-sensing miniature switches connected in series and embedded within the motor windings shall be provided to shut off power and initiate alarm light for motor over temperature condition. See drawing [which is on file with the city engineer].
- C) *Pump Controls.* The Control Panel (CP) to be provided by the pump manufacturer in a NEMA 3R stainless steel enclosure. The exterior construction will be stainless steel of NEMA 3R weather tight construction, with hoop and padlock. Cabinet internal door to be aluminum dead front construction with 8" continuous hinge. Duplex 120v receptacle to be provided in the panel. Shop drawing required for approval. The submersible station control panel shall be pole mounted or a free standing enclosure. Each pumping station control system shall include:
  1. The CP shall include the following:
    - (a) Emergency generator circuit breaker with interlock.
    - (b) Emergency generator plug-in receptacle.
    - (c) For stations utilizing pumps smaller than 15hp, the receptacle shall be model JRE4100 as manufactured by Pyle National.
    - (d) For stations utilizing pumps 15hp and larger the receptacle shall be a model JRSB2044 as Manufactured by Russell-Stoll.
  2. *Lightning Arrestors and Surge Protection.* Lightning arrestors shall be Square D model SDSA365 series 001 or approved equal.
  3. *D.C. Alarms with Battery & Charger.* Alarm to be energized by power/phase failure or high water level float indication. External components:
    4. A liquid level controller which shall sense the sewage level in the wet well and provide appropriate signals to the logic circuits to produce the required mode of operation for the pumping units, as well as the normal automatic control from the liquid level sensing and logic circuits.
    5. An automatic alternator shall change the starting sequence on each pump cycle. High and low water level alarm system shall be provided. The pump alternator will have alternator test. Float balls are preferred over transducers to trigger pump alternations.
    6. Each sewage pump shall be provided with an elapsed time meter to indicate pump running times.
    7. The control panel is to include a terminal strip for connection to a Remote Terminal Unit (RTU). At a minimum auxiliary contacts shall be incorporated in the control panel to:
      - (a) Turn the pumps on or off
      - (b) Silence alarm horn from a remote signal

- (c) Monitor lift station status and control program such as remote alarm notification, data logging and real-time updates.
- (d) Phase monitor
- (e) Pump failures
- (f) Wet well levels

8. The RTU shall be SCI-Text communications system by Sanders Company Inc. The SCADA HMI (and graphics) will be updated to monitor and control the lift station. The RTU shall be installed adjacent to the Control Panel.

- D) *Submersible pump facilities.* Sewage pumping stations of the submersible type are suitable where the peak design flow rate does not exceed 1,000 gallons per minute or the pump motor size is 30 horsepower or less. Said installation shall include the removable pump units, aluminum access frame and cover, stainless steel pipe pump guide bars, pump discharge connection and other necessary appurtenances. The submersible pumping system and accessories shall be as manufactured by Flygt Corporation, Norwalk, Conn., or approved equal. See standard drawing at the end of this section.
- E) *Factory-built facilities.* Factory-built facilities shall have prior city approval before inclusion in proposed plans. Example; Century-APPTECH SOLUTIONS structurally reinforced and pressure rated HDPE with ACI compliant HDPE encapsulated reinforced concrete composite base.
- F) *Emergency on-site standby generator.* An on-site standby emergency generator shall be provided for phase & power failure protection and installed at lift stations with capacity at or over 700 gpm flow and/or as required by DEP, and/or under special circumstances due to remoteness of site for lift stations smaller than the above cited standards. See generator Specification at the end of this section.

7.34. *Hoist for submersible lift stations.* Not all lift stations require hoists, however those stations deemed as hoist required by the city engineer the following requirements will apply:

- A) The hoist shall be manufactured by Ace Boat Hoist Co. or approved equal. The hoist shall be attached to the wet well. The controls and panel shall be NEMA 4 rated, with a forward and reverse motion and holding a load with no modifications or adjustments of pulley or belts. The reach shall be from the centerline of the base and shall be capable of reaching the farthest and nearest pump with adjustments of the lifting cable along the boom and be able to rotate 360 degrees.
  - All structure components shall be fabricated from steel tubing with hot dipped galvanized treatment. Each component must be cleaned and free of rust, grease or flux.
  - All rotating parts shall be mounted on bushings or bearings which can be routinely lubricated.
  - Lifting cables shall be operated by an electric powered hoist mechanism capable of lifting 2,000 pounds and be equipped with an emergency heavy-duty brake. All electrical components shall be covered and protected from weather.
  - Cable shall be stainless steel, rated for 4,000 pounds and shall be a minimum of 60 feet in length.
  - Snatch blocks and hooks shall be compatible with cables and capable of supporting loads up to 4,000 pounds.
  - All anchor bolts shall be stainless steel and of a sufficient cross sectional area to resist any force created by the hoist in any position at the maximum load as specified.
- B) *Submittals - drawings.* Drawings shall include construction, installation, maintenance schedule and any other equipment required for proper installation and operation. All drawings are to be submitted to the City of Eustis Public Utilities Department.

7.35. *Valves.*

- A) *Valve vaults.* Valve vaults must be a minimum of six feet by six feet, with no less than 12 inches from the side wall to the valve clearance. Vault must be coated, with Bituminous 300M inside and outside with a finish coat of 40 mils. All metal on the inside of the valve vault shall be coated with Bituminous 300M and will also have a finish coat of 40 mils.
- B) *Valves.* All valves used in station valve boxes shall be DeZurik Series with 100 percent full flow plug valves. Any valve six inches or over must be gear operated.
- C) *Plug Valve.* Plug valve on by-pass line shall be buried with access. Valves to be supplied with 2" operator and steel "T" Handle operator Wrench. Handles to shall project 3' above finished grad when in place.
- D) *Check Valves.* Swing check valves are to be weighted, "not spring controlled". The weight can be painted steel.

7.36. *Fence requirements.* Sewage pumping stations require fencing in accordance with standards established in section 5.10 of Chapter 2.

7.37 *Construction and Component Materials.* All nuts, bolts, washers and miscellaneous hardware to be 316 stainless steel in valve vault, wet well and throughout station, including wall brackets and anchor bolts.

- A) *Access Covers and Hatches.* Access hatch for wet well and valve vault to be 300# rated checkered aluminum plate with padlock staple and hasp, swing handle and 316 stainless steel fittings and accessories as manufactured by "Halliday" or approved equal. Hatch frame to be integrally cast in top of vault as noted on attached lift station design drawing at end of this section.
- B) *Gauges.* Gauges to be stainless steel 0-50 liquid filled mounted on pipe downstream from Check Valve.
- C) *Quick Disconnect Coupling.* Quick disconnect hose couplings shall be 4" nominal diameter. through cast iron street boxes. By-pass/pump out connection to be aluminum cam and groove design.
- D) *Conduit.* All exposed and embedded conduits to be schedule 80 PVC. All electrical conduit to the meter from the power source shall be embedded as approved by the City.

#### 7.4 Lift Station Generator Specifications

##### I. SPECIAL CONDITIONS

###### A. Testing

1. Prior to shipment, the new generator set and equipment shall be tested at the manufacturer's plant to demonstrate the suitability of the equipment as part of complete installation. The manufacturer shall certify that this electric set series has been developed through vigorous, comprehensive tests to include:

- Maximum power level
- Maximum motor starting capacity
- Endurance tests
- Structural soundness
- Torsi graph analysis per MIL-STD-705B, Method 504.2
- Fuel Consumption
- Engine – Alternator cooling air flow
- Transient response and steady state governing
- Alternator temperature rise per NEMA MG1-22.40 definition
- Single step load pick-up
- Harmonic analysis and voltage waveform deviation per MIL-STD-705B, Method

2. The performance of the electric set series shall be certified as to the set's full power rating, stability and voltage frequency regulation by an independent testing laboratory. The electric set shall be free of injurious torsional stresses within plus or minus 10 percent of rated speed and a torsional analysis shall be calculated by the manufacturer of the electric set and submitted to the City.

- B. Delivery – The equipment delivered under this bid shall remain the property of the contractor until a physical inspection shows it to be in compliance with the specifications and the unit is operating properly. Delivery of generators will be scheduled with Director of Wastewater, Bill Johnston, or his assignee at 352-357-4282. All generators must be delivered on a flatbed truck.
- C. Warranty – The successful contractor shall warrant the equipment to be free from defects in material and workmanship under normal use and service for the standard warranty of the equipment. The generator system components, complete engine.

The electric generator system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of at least twelve (12) months. Any defective parts shall be repaired or replaced at the manufacturer's option, free of charge for travel and labor. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable.

- D. Parts List – At time of delivery, the vendor shall furnish a complete parts list of all equipment with part numbers. Parts shall be available on short term notice.
- E. Diagrams/Drawings – Schematic drawings, wiring diagrams, maintenance and operational manuals shall be provided with the system.
- F.
- G. Manufacturer's Services – The complete generator set shall be initially started and checked out for operational compliance by a representative of the engine manufacturer. The engine lubrication oil and antifreeze shall be as recommended by the manufacturer for operation under environmental conditions specified in Specification B. The initial startup by the manufacturer's representative shall include the load bank testing specified herein and provide instructions of the City's Personnel for ½ day in operation and maintenance of the unit.
- H. Requirements of Regulatory Agencies – The generator set must conform to all current N.E.C. and any other applicable inspection authorities. The transfer switch shall be labeled under UL1008.

## II. GENERATOR SPECIFICATIONS

The generators supplied shall be capable of fully operating system of high industrial standards and shall include all main and associated components in addition to the following requirements as specified. Generator specifications given are minimum requirements only, and are not limited to just those items mentioned.

- A. ENGINE – The engines shall be liquid cooled, natural gas/LP combination, 3 phase, with the required minimum power rating listed below, and shall be sufficient to individually start one pump at a time, two pumps continuous. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. The engine speed shall be governed by an electronic governor to maintain alternator frequency

within .05% from no load to full load alternator output. The steady state regulation shall be 0.25%

1. Factory Installed Components – The following items should come installed at the factory:
    - A 2-Amp. Automatic float battery charger. It shall be of a solid-state design and self-regulating to prevent overcharging the system battery. The battery charger mounted in the transfer switch will be unacceptable.
    - The engine shall have a unit mounted, thermostatically controlled water jacket heater to aid in quick starting. It shall be of adequate wattage as recommended by the engine manufacturer. The contractor shall provide the proper branch circuit from a normal utility source.
  
  2. Engine Instrumentation – Engine instrumentation shall consist of an oil pressure gauge, coolant temperature gauge, DC ammeter and an engine run hour meter located on the unit control panel. The control panel will also have a mounted voltage adjuster and it must have a shaft-locking device to avoid accidental adjustment.
  
  3. Sensing Elements – Sensing elements will be provided for:
    - Low oil pressure shutdown
    - High coolant temperature shutdown
    - Low coolant level shutdown
    - Over speed shutdown; and
    - Over crank shutdown
  
  4. Wiring – All wiring shall run in flexible conduit for protection from the environment and any moving objects. Wiring number labeling on each end of the wire run should be provided for ease of identification.
- B. ALTERNATOR CONTROLS** – All engine alternator controls and instrumentation shall be designed, built, wired, tested and shock mounted in a NEMA 1 enclosure to the engine-generator set by the manufacturer.
1. Controls – The controls shall contain panel lighting, a fused DC circuit to protect the controls and a +/-5% voltage adjusting control.
    - A. The Control panel must be able to be rotated 90 degrees in either direction to ensure proper installation.
    - B. The following shall be panel mounted:
      - Voltmeter
      - Ammeter
      - Frequency meter
      - Run time meter voltmeter.
  
  2. Safety Shutdown – The safety shutdown monitoring system shall include an engine monitor with individual lights and one common external alarm contact

indicating the following conditions:

A. The engine RPM shall be monitored. If there is a failure in the circuit, the engine must shut down immediately and illuminate a loss of RPM sensor shutdown.

B. The red annunciation lamp shall be illuminated when the 3-position switch is not in "AUTO".

C. **AUTOMATIC TRANSFER SWITCH** – The automatic transfer switch shall be furnished by the manufacturer of the engine generator set so as to maintain the system compatibility and local service responsibility for the complete emergency power system. It shall be listed by the Underwriter's Laboratory Standard 1008 with circuit breaker protection.

1. Wiring – The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.
2. Controls – All control equipment for the transfer switch shall be mounted on the inside of the cabinet in a stainless steel or aluminum enclosure with transparent safety shield to protect all circuit boards. Control boards shall have cover plates installed to avoid shock hazard while making control adjustments. The transfer switch shall contain the following features.
  - Engine warm-up
  - Engine warm-up bypass
  - Frequency set
  - Voltage set
  - Return to utility delay
  - Engine cool down
  - Minimum run
  - 7-day exercise
  - Utility voltage sensor / Phase monitor
  - VL-1008 listed
  - The switch shall be of a voltage to match the generator with remote status indicator, in-phase/logic control system, control and time delay and neutral auxiliary contacts.
3. Under Voltage Sensor – An under voltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and dropout settings shall be adjustable from a minimum of 70% to a maximum of 95% or nominal voltage. The utility sensing interface shall be used, stepping down line voltage to 24 VAC, helping to protect the printed circuit board from voltage spikes.
4. Safety Disconnect Switch – Provide a safety disconnect switch to prevent a load transfer and automatic engine start while performing maintenance. This switch will also be used for the annual transfer switch operation.
5. LED Status Light –The manufacturer shall provide LED status lights to give a visual readout of the operating sequence. This shall include utility

on, engine warm-up bypass, standby voltage “ready”, standby frequency “ready”, stand by on, transfer to standby, in-phase monitor, time delay neutral, return to utility, engine cool-down, engine minimum run and fast test mode.

**D. ENCLOSURES**

1. Transfer switch Enclosure – The transfer switch mechanism and control shall be mounted in a NEMA 4X stainless steel.
2. Generator Set Enclosure – The engine generator set shall be factory enclosed in a Type 316 stainless steel or aluminum enclosure. The enclosure shall have large hinged doors to allow access to the engine, alternator and control panel. The doors must lift off without the use of tools. Each door shall have lockable hardware with identical keys. Padlocks do not meet this specification. Enclosure shall be capable of withstanding winds in excess of 125 mph.

**Additionally**, the generator set will be permanently located in residential areas and require increased sound dampening controls as follows:

- Include an internally mounted muffler; and
- Sound insulating panels, which reduce the sound level of the set to a level below that achieved with a standard (level 1) enclosure.

**E. OWNER’S MANUALS** – Three (3) sets of owner’s manuals shall be provided for each generator upon delivery of the generator set. Owner’s manuals shall show general operating instructions, preventative maintenance, wiring diagrams, schematics and parts exploded views.

**F. INSTALLATION** – Installation of generators will be performed by others.

**G. SERVICE** – The successful vendor shall have permanent service facilities in the trade area. These facilities shall comprise a permanent force of factory trained personnel on 24-hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the City maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

**H. START-UP AND CHECKOUT** – The supplier of the electric generator set and associated items covered herein shall provide factory trained technicians to check out the completed installation and to perform an initial startup inspection to include: (Please note: There may be a lapse of time between delivery and startup)

- Ensure the engine starts (both hot and cold) within the specified time
- Verify engine parameters within specifications.
- Set no load frequency and voltage

- Test all automatic shutdowns of the engine-generator
- Perform a load test of the electric plant, ensuring full load frequency and voltage is within specifications.

- I. **SUBMITTALS** – Successful vendor shall provide four (4) complete sets of the Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine and generator. Submittal shall include compliance with these specifications.

## SECTION 8. - WATER DISTRIBUTION SYSTEMS

### Sec. 8.1. - General.

This section sets forth the general requirements for construction and installation of water distribution systems for potable water service.

### Sec. 8.2. - Design standards.

The design standards of the water system are listed in section 5.3.

### Sec. 8.3. - Standard requirements.

8.31. *General.* The materials of construction and general installation procedures, with the exception of fire hydrants, shall comply with the specific applicable standards set forth under section 2, "Utility Excavation, Trenching and Backfilling"; section 3, "Boring and Jacking"; and section 4, "Pipe, Fittings, Valves and Appurtenances," as well as "Standard Details-Water Distribution Systems."

8.32. *Fire hydrants.* Hydrants shall comply with AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Services," and shall be equipped with a minimum of one pumper outlet nozzle 4 ½ inches in diameter and two hose nozzles 2 ½ inches in diameter. Threads, nozzle caps, operating nuts and color shall conform to city standards. Units shall be traffic type with breakable safety clips or flange, and stem with safety coupling located below barrel break line to preclude valve opening. Hydrants shall be dry top type. Outlet nozzles shall be on the same plans, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5 ¼ inches minimum opening unless otherwise requested and show inlet connection to be six inches minimum.

- A) Hydrants shall be installed plumb and in true alignment with the connection pipes to the water main. They shall be securely braced against the end of the trench (undisturbed soil) with concrete thrust blocks. The gravel or crushed stone for the drain sump, followed by backfilling, shall be carefully placed and compacted. Installed hydrants shall be painted red for the final coat.
- B) Hydrant placement is to be a minimum of six feet and a maximum of nine feet from the curb or paved road surface unless otherwise approved.

The center of the steamer port shall be 18 inches minimum and 24 inches maximum above final grade.

Steamer port shall be correctly positioned for the proper connection.

8.33. *Joint restraining.* Pressure piping fittings and other items requiring restraint, shall be braced with thrust blocks or other items restraining assemblies. Said restraining devices shall be designed for the maximum pressure condition (testing) and the safe bearing loads for horizontal thrust, if thrust blocking is used.

8.34. *Pipe depth and protection.* The standard minimum cover for water distribution systems shall be three feet from the top of the finish grade. However, should this design not be feasible, protective concrete

slabs shall be provided over the pipe within the limits of the lesser cover. Where waterways, canals, ditches or other cuts are crossed, protective concrete slabs shall also be installed across and to ten feet each side of the bottom. Additionally, approved utility crossing signs shall be placed on the pipe alignment at each side of the canal, etc. All water lines and sewer lines must have a metallic tape trace placed twelve to sixteen inches above the crown of the pipe.

8.35. *Connections at structure.* Where pipes are to extend into or through structures, flexible joints are to be provided at the wall face.

8.36. *Special exterior protection for corrosion.* Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, cast or ductile iron pipe crossing said utility shall be installed parallel to and within ten feet of, protection shall also be provided. Steel pipe shall not be installed in severe corrosion areas.

8.37. *Air venting and blowoffs.* Where the water main profile is such that an air pocket or entrapment could occur, resulting in flow blockage, methods for air release shall be provided. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants, blowoffs, or other manual devices. At critical points on major mains, automatic air release assemblies shall be installed. Special care shall be taken to preclude any cross connection possibility in the design of automatic air release valve application. All dead-end water mains, temporary or permanent, shall be equipped with a manually operated blowoff at the terminal.

8.38. *Service connections.* Connections to water mains four inches and larger shall be made by drilling the appropriate size hole and installation of service saddles, with services to smaller sizes accomplished by in-line fittings. A fitting with the service line extended to the property line, perpendicular to said line, and terminating with a plugged curb stop, pending meter installation. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb and painted blue. Where no curb exists or is planned, locations shall be adequately marked by a method approved by the city.

Sec. 8.4. - Testing.

- A) The contractor shall perform hydrostatic testing of all water distribution systems, as set forth in the following and shall conduct said tests in the presence of representatives from the city and/or other authorized agencies, with 48 hours' advance notice provided.
- B) Piping and appurtenances to be tested shall be within sections between valves, unless alternate methods have received prior approval from the city. Testing shall not proceed until concrete trust blocks are in place and cured, or other restraining devices installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided, if required.
- C) Hydrostatic testing shall be performed at 150 pounds per square inch pressure, unless otherwise approved by the city, for a period of not less than two hours. Testing shall be in accordance with the applicable provisions as set forth in Section 13, AWWA Standard C600. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

DIP:			PVC:		
L(DIP)	=	$\frac{S D (P)^{1/2}}{133,200}$	L(PVC)	=	$\frac{N D (P)^{1/2}}{7,400}$

L	=	allowable leakage in gallons per hour
N	=	number of joints
S	=	length of pipe tested in feet
D	=	nominal diameter of the pipe in inches
P	=	average test pressure maintained during the leakage test in pounds per square inch gauge.
(Note: Leakage for PVC on L(DIP), use 0.9 L(DIP))		

- D) The testing procedure shall include the continued application of the specified pressure to the test system, for the two-hour period by way of a pipe taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.
- E) Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until within the established limits. The contractor shall furnish the necessary labor, water, pumps, gauges and all other items required to conduct the required water distribution system testing and perform necessary repairs.

Sec. 8.5. - Disinfecting.

8.51. Following the pressure testing, the contractor shall disinfect all sections of the water distribution system, and receive approval thereof from the appropriate agencies, prior to placing in service. Advance notice shall be provided to the city before disinfecting procedures start. The disinfection shall be accomplished with the applicable provisions of AWWA Standard C651, "Standard Procedures for Disinfecting Water Mains" and all appropriate agency approvals.

- A) Care shall be taken to provide disinfection to the total system and extremities shall be carefully flushed prior to chlorination.  
  
After disinfection and final flushing have been accomplished, samples of water for bacteriological analysis shall be collected and submitted to and as directed by the Florida Department of Environmental Protection or other appropriate approval agency. Should these samples or subsequent samples prove to be unsatisfactory, then the piping shall be disinfected until a sufficient number of satisfactory samples are obtained.
- B) The contractor shall furnish all equipment and materials and perform the work necessary for the disinfecting procedures, including additional disinfection as required.

Sec. 8.6. - As-built drawings.

8.61. The developer must provide a digital copy (PDF and CAD format) and three white copy set of as-built drawings of the project, showing accurate measurements of water and sewer lines and structures from fixed known locations within the development. The as-builts shall be signed and sealed by the project

design engineer attesting to the accuracy of the locations of the facilities. The as-built drawings are to be provided before the city can accept the improvements. The developer is to provide four copies of the plans for approval by the city.

Sec. 8.7. - Illustrations and drawings.

The illustrative drawings that may be required are on file with the city engineer.

# **CHAPER FOUR**

**MANUAL OF  
CROSS CONNECTION CONTROL**

**CITY OF EUSTIS  
WATER DEPARTMENT**

**CHAPTER 4**  
**MANUAL OF**  
**CROSS CONNECTION CONTROL**  
  
**CITY OF EUSTIS**  
**WATER DEPARTMENT**

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# MANUAL OF CROSS CONNECTION CONTROL

## SECTION 1 INTRODUCTION

A cross connection is defined by the American Water Works Association (AWWA) as: “any connection or structural arrangement between public or a consumer’s potable water system and any non-potable source or system through which backflow can occur. Bypass arrangements, jumper connections, removable sections and other temporary or permanent devices through which or because of which, backflow can occur are considered cross connection.”

Backflow, literally a reversal in the normal direction of flow within a water system, is what turns a cross-connection into a health hazard. Consequently, cross-connection and the chance of backflow must be eliminated to prevent these “unseen hazards” from degrading the quality of water that water providers strive to maintain.

### 1.01 Purpose

The purpose of a cross-connection control program is to prevent diseases and contamination from entering the potable water distribution system and the water we drink. The program aims to protect the consumers and the City of Eustis from those water using establishments which could possibly reduce the quality and safety of the municipal water supply through backflow and cross-connection.

### 1.02 Legal Authority

The Safe Drinking Water Act, signed by President Ford on December 16, 1974, created new authority through a chain of laws and regulations that resulted in the State Requirement (Florida Safe Drinking Water Act Section 403.850 - 403.864, Florida Statutes) for all public water systems to have a cross-connection control program. Contained within the rules of the Department of Environmental Protection (D.E.P.), Chapter 62-555 (Formerly 17-22). The State of Florida, on November 9, 1977, adopted the following policy:

“Community water systems are required to establish a routine cross-connection program for the purpose of detecting and preventing cross-connections that create an imminent and substantial danger to the public health by and from contamination due to the cross-connection, both community and non-community

water systems shall either eliminate the cross-connection by installation of an appropriate backflow prevention device acceptable to the Department of Environmental Protection (D.E.P.) or discontinue service until the contamination source is eliminated.” Chapter 62-555.360 (Formerly 17-22.160 F.A.C.)

The City of Eustis adopted Ordinance No. 02-57 as amended and replaced by 10-25 & 16-31, Sect. 118-20 Cross Connection Control – Manual Adopted, for the purpose of establishing rules and regulations for the installation, repair and maintenance of backflow prevention and cross connection control devices, the manual of cross connection control by reference, and the whole of such manual, including appendixes, and any subsequent editions or amendments.

### 1.03 Causes of Backflow

Where cross-connections exist, protection against backflow is needed to reduce the possibility of contamination. The causes of backflow cannot usually be eliminated completely since backflow is often initiated by accidents or unexpected circumstances. However, some causes of backflow can be partially controlled by good design and informed maintenance. Listed below are the major causes of backflow as outlined under the two types of backflow-backsiphonage and back pressure.

#### A. Backsiphonage

Backsiphonage is caused by reduced or negative pressure being created in the supply piping. A major cause of backsiphonage is the interruption of the supply pressure. This will allow negative pressure to be created by water trying to flow to a lower point in the system. Another cause is undersized piping. If water is withdrawn from a pipe at a very high velocity, the pressure in the pipe is reduced and the pressure differential created can cause water to flow into the pipe from a contaminated source. The potable water supply can thus become contaminated due to backsiphonage of contaminants into the potable water supply creating the potential for serious health problems.

The principal causes of backsiphonage are:

1. A line repair or break which occurs at a

- lower elevation than the service point.
2. Undersized pipe.
3. Lower pressure in a water main due to a high water withdrawal rate such as fire-fighting, water main flushing or water main breaks.
4. Reduced supply main pressure on the suction side of a booster pump.

#### B. Backpressure

Backpressure may cause backflow to occur where a potable water system is connected to a non-potable system of piping, and the pressure in the non-potable system of piping, exceeds that in the potable system. High pressures may be created by means of pumps, boilers, etc. There is a risk of non-potable water being forced into the potable water system whenever these types of cross-connections are not properly protected.

The principal causes of backpressure are:

1. Booster pump systems designed without backflow prevention devices.
2. Potable water connection to boilers and other pressure systems without backflow prevention devices.
3. Connections with a non-potable system which may, at times have a high pressure.
4. Non-potable water stored in tanks or plumbing systems which, by virtue of their elevation, would create head sufficient to cause backflow if pressure were lowered in the public system.

## SECTION 2 OBJECTIVES

The objectives of the City of Eustis Water Department Cross-Connection Control Program are as follows:

1. To protect the City of Eustis water supply from the possibility of contamination by containing within its consumer's private water system, contaminants or pollutants which could, under adverse conditions, backflow through uncontrolled cross-connections into the public water system.

2. To eliminate or control existing cross-connections, actual or potential, between the consumer on premise potable water system and non-potable water systems plumbing fixtures and industrial piping systems.
3. To provide an inspection program of cross-connection control, which will systematically and effectively control all actual or potential cross-connections which exist presently or may exist in the future.

## SECTION 3 RESPONSIBILITY

### 3.01 Cross-Connection Control

Under the rules of the Florida Department of Environmental Protection, Chapter 62-555.360 relating to cross-connections. The water purveyor has the primary responsibility to prevent water from unapproved sources, or any other substances, from entering the public water system upon detection of a prohibited cross-connection. The Eustis Water Department is directed to either eliminate the cross-connection by requiring the installation of an approved backflow device or discontinue service until the contaminate source is eliminated.

### 3.02 Consumer

The consumer's responsibility starts at the point of delivery from the public potable water system and includes all of his water system. The consumers, at his own expense, shall install, operate, test and maintain approved backflow prevention devices. The consumer shall maintain accurate records of repairs made to backflow prevention devices and provide the Eustis Water Department with copies of such records. The records shall be on forms approved or provided by the Eustis Water Department.

In the event of accidental pollution of consumer's potable water system due to backflow on or from consumer's premises, the owner shall promptly take steps to confine further spread of pollution or contamination within the consumer's premises, and shall immediately notify the Eustis Water Department of the hazardous condition.

### 3.03 Backflow Prevention Device Installer

The installer's responsibility is to make proper installation of backflow prevention devices in accordance with the manufacturer's installation instructions and those furnished by the Eustis Water Department. See examples of backflow prevention device installation in section 10. The installer is also responsible to make sure a device is working properly when it is installed and is required to furnish the following information to the Cross-Connection Control Program immediately after a reduced pressure principle backflow preventer (RP), double check valve assembly (DCVA) or pressure vacuum breaker (PVB) is installed:

1. Service address where device is located.
2. Owner.
3. Description of device's location.
4. Date of installation.
5. Type of device.
6. Manufacturer.
7. Model number.
8. Serial number.

After installation, all RP's, DCVA's and PVB's shall be inspected by the City of Eustis and tested by a certified tester to ensure proper operation of these devices.

#### SECTION 4 POLICY

The Eustis Water Department will provide continuing inspection of all industrial and commercial users of potable water, where it is probable that a pollitional health or system may be created or where materials dangerous to health are handled in tanks, piping systems, or other vessels on the premises or where the water system is unstable and cross-connections may be installed.

The following regulations to cross-connection will apply:

1. Should the connection be between two (2) approved public water supplies, common gate or check valve maybe used provided this has the approval of both water supplies and the Florida Department of Environmental Protection.
2. Should the connection be between an approved public water supply and a service or other water supply not hazardous to health but not meeting the standards of the approved water supply, and not cross-connected within its system with a potentially dangerous water or liquid, an approved double check valve assembly (DCVA) may be used.

3. Should the connection be between an approved public water supply and a service or other water supply which has or may have any material in the water dangerous to health, that is, or may be handled under pressure, subject to negative pressures, protection shall be an approved air-gap separation (AG). The air-gap shall be located as close as practicable to the service cock or other connection to approved supply. All piping between such connections and air-gap shall be entirely visible. If these conditions cannot reasonably be met, the public water supply shall be protected with an approved reduced pressure principle backflow device (RP), provided the alternative is acceptable to the water purveyor.
4. This Policy shall specify the frequency for refurbishing or replacing dual check valve devices (DuCV's) being required at or for service connections. DuCV's being required at for service connections pursuant to Table 62-555.360-2, which appears at the end of Rule 62-555-360, F.A.C., shall be refurbished or replaced at least once every 5 to 10 years or at a lesser frequency determined by the CWS if the CWS documents that the lesser frequency is appropriate based on data from spot-testing DuCV's in its system or based on data from backflow sensing meters in its system.
  - 4.02 There is adopted by the city, for the purpose of establishing rules and regulations for the installation, repair and maintenance of backflow prevention and cross connection control devices, the manual of cross connection control by reference, and the whole of such manual, including appendixes, and any subsequent editions or amendments. One copy of such manual is to be filed in the office of the building official, the director of water, and the fire chief and the manual is adopted and incorporated in this section by reference as fully as if set out at length in this section; and from the date on which this section shall take effect, the provisions of such manual shall be controlling in the installation, repair and maintenance of backflow prevention and cross connection devices in the city and on and to the city's utility system and connections to the system. One copy of the manual is to be filed in the city clerk's office.
  - 4.03 There is adopted by the city, for the purpose of establishing rules and regulations for the installation, repair and maintenance of backflow prevention and cross connection control devices, the manual of cross connection control by reference, and the whole of such manual, including appendixes, and any subsequent editions or amendments. One copy of such manual is to be filed in the office of the building official, the director of water, and the fire chief and the manual is adopted and incorporated in this

section by reference as fully as if set out at length in this section; and from the date on which this section shall take effect, the provisions of such manual shall be controlling in the installation, repair and maintenance of backflow prevention and cross connection devices in the city and on and to the city's utility system and connections to the system. One copy of the manual is to be filed in the city clerk's office.  
(Ord. No. 10-25, § 1(Exh. A), 9-23-2010)

- 4.04 All territory within the city and the county served by the city potable water system shall be governed by this article to the extent permitted by law. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.05 The city commission shall periodically revise the manual of cross connection control as may be deemed necessary for the public, health, safety and welfare of the users of the city's water system or for protection of the utility system, and to effect cost-effective implementation of the provisions of the manual. The city commission may make revisions to the manual by duly adopted resolution of the city commission. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.06 The cross connection control manual does not supersede the Florida Building Code —Plumbing 2001 as adopted by the city, the state department of health plumbing rules, or any adopted city plumbing or fire ordinance, but is supplementary to them; when conflicts exist the more restrictive provision shall apply. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.07 *Penalty.*
- (a) Any person, user, customer, or property owner found guilty of violating any of the provisions of the cross connection control manual or any written order of the city shall be punishable in accordance with section 1-14. Additionally, such person, customer, user, or property owner shall pay all costs and expenses involved in the case, to include attorney's fees.
- (b) *Violation notice.* Notice of violations of the manual of cross connection control shall be given by delivering the notice to the premises of the violating connection, a copy mailed to the billing address as it appears on the city's billing records, and a copy to the owner of record at the address of record listed in the most current county property tax roll. Each day upon which a violation of the provisions of the manual shall occur shall be deemed a separate and additional violation. Any

person, user, customer or property owner in violation of any of the provisions of the manual shall become liable to the city for any expense, loss or damage incurred by the city for reason of such violation, to include attorney's fees. In addition to any penalty provided by law for the violation of any of the provisions of the manual, the city may bring suit in the appropriate court to enjoin, restrain or otherwise prevent the violation of any of the provisions of this article.

(Ord. No. 10-25, § 1(Exh. A), 9-23-2010)

- 4.08 The city, in addition to the procedure specified in section 118-20.3, may use the code enforcement provisions set forth I [in] chapter 2 of this Code to enforce the provisions of the manual of cross control connections. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.09 No provision of this article designating the duties of any city officer or employee shall be so construed as to make such officer or employee liable for any fine or penalty for failure to perform such duty. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.10 The city manager or his designee of the utility system shall cause inspection to be made of all properties served by the utility system's public water supply where cross connections with the public water supply is deemed possible. The frequency of inspections and re-inspections based on potential health hazards involved shall be as established by the manual of cross connection control. Fees for inspections and re-inspections shall be as established in the manual of cross connection control and as may be changed by the city commission by duly adopted resolution of the city commission and on file in the city clerk's office. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.11 Duly authorized employees of the city bearing proper credentials and identification shall be permitted to enter any building, structure or property served by a connection to the public potable water supply system of the city for the purpose of inspecting the piping system of systems on such property. Consent to such access shall be obtained from a person of suitable age and discretion or in control of the building, structure or property. The refusal of such information, or the refusal of access when

requested, shall be deemed evidence of the presence of cross connections. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)

- 4.12 The city manager or his designee is authorized and directed to discontinue potable water service to any property after notice, wherein any connection in violation of the manual of cross connection control exists, and to take such other precautionary measures deemed necessary to eliminate any danger of contamination of the public potable water supply system. Water service to such property shall not be restored until the cross connection has been eliminated in compliance with the provisions of this article. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)
- 4.13 The consumer, user or owner shall bear all expense of installing, testing and maintaining the protective devices required by the manual of cross connection control to ensure proper operation on a continuing basis. Testing of protective devices shall be conducted by a person holding a current certification recognized by the state department of environmental protection in cross connection and backflow prevention devices and approved by the city utility system for inspection and testing purposes. A testing fee will be charged by the city for each test and retest of the backflow or cross connection control device performed by city personnel or contract agent. The consumer shall keep records on the premises on his testing, maintenance and repair activities related to cross connection control and shall make these records available upon request to agents of city performing inspections or testing on the property. Copies of all maintenance and repair records shall be sent to the city's cross connection control program immediately after the work is performed by the user, customer or owner in accordance with the provisions of the manual of cross connection control. (Ord. No. 10-25, § 1(Exh. A), 9-23-2010)

## SECTION 5 INSPECTIONS

### 5.01 Frequency

Due to changes in models or components of equipment, methods of manufacturing and additions to plants, buildings, etc., water use requirements undergo continual change. As a result, new cross-connections may be installed and existing protection may be by passed, removed or made otherwise ineffective; therefore, an annual or more frequent detailed inspection of all industrial, commercial and in some cases privately owned water usage is required.

### 5.02 New Construction

All new construction plans and specifications for industrial or commercial facilities shall be made available to the Water Department Cross-Connection Control Program to determine the degree of possible cross-connection hazards. The Community Development Division has agreed to furnish these plans to the program for construction within the City limits and that portion of the water service area outside the City limits.

### 5.03 New and Existing Facilities

In order to determine the degree of hazard to the public potable water system, a survey will be made of the consumer's presently installed water system. This survey need not be a detailed inspection of the location or disposition of the water lines, but can be confined to establishing the water uses on the premises, the existence of cross-connections and the availability of auxiliary or used water supplies. Onsite inspections are made of new and existing facilities and should any devices or plumbing changes be required, a follow-up inspection will be made of the same facilities at a later date.

## SECTION 6 DEFINITIONS

AIR-GAP SEPARATION - The term air-gap separation shall mean a physical separation between the free-flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel. An approved air-gap separation shall be a distance of at least two (2) times the diameter of the supply pipe measured vertically above the top rim of the vessel - with a minimum distance of one (1) inch.

AUTOMATIC METER READING (AMR) – The term AMR means the technology of automatically collecting consumption, diagnostic, and status data from a water meter and transferring that data to a central database for billing, troubleshooting, and analyzing.

APPROVED - a.) The term approved, as herein used in reference to a water supply, shall mean a water supply that has been approved by the Florida Department of Environmental Protection. b.) The term approved, as herein used in reference to air-gap separation, a double check valve assembly, or a reduced pressure principle backflow prevention device or other backflow prevention device or method, shall mean as approved by the City of Eustis Water Department.

AUXILIARY INTAKE - The term auxiliary intake shall mean any piping connection or other device whereby water may be secured from a source other than that normally used.

BACKFLOW - The term backflow shall mean the undesirable reversal of the flow of water or other liquids, mixtures, gases or other substances into or towards the distribution piping of a potable supply of water from any source or sources.

BACKFLOW PREVENTION DEVICE - A backflow prevention device, shall mean any effective device, method or construction used to prevent backflow into a potable water system. The type of device used should be based on the degree of the hazard, either existing or potential, and identified by the condition which it is designed to prevent.

BACKFLOW PREVENTION DEVICE - APPROVED - The term approved backflow prevention device shall mean a device that has been investigated and approved by the City of Eustis Water Department and has been shown to meet the design and performance standards of the American Society of Sanitary Engineers (ASSE) and/or the American Water Works Association (AWWA). The approval of backflow prevention devices by the City of Eustis Water Department is based on a favorable report by an approved testing laboratory, recommending such an approval.

BACKFLOW PREVENTION DEVICE TESTER - CERTIFIED - The term backflow prevention device tester shall mean a person who has proven his/her competency to the satisfaction of the City of Eustis Water Department. Each person who is certified to make competent tests or to repair, overhaul and make reports on backflow prevention devices shall be conversant with applicable laws, rules and regulations, have had a least two years of experience under a licensed plumber or have other qualifications which in the opinion of the City of Eustis Water

Department are equivalent, and shall have attended and successfully completed the TREEO (Training, Research and Education for Environmental Occupations) Certification Program for Backflow Prevention Device Testers, or other USCFHR or D.E.P. approved program.

BACKPRESSURE - Backpressure shall mean any elevation or pressure in the downstream piping system (by pump, elevation of piping, or stream and/or air pressure) above the supply pressure at the point of consideration which would cause or tend to cause, a reversal of the normal flow through a backflow prevention device.

BACKSIPHONAGE - Backsiphonage shall mean a reversal of the normal direction of flow in the pipeline due to a negative pressure (vacuum) being created in the supply line with the backflow source subject to atmospheric pressure.

CONSUMER - Any person, firm or corporation using or receiving water from the City's water system.

CONTAMINATION - The term contamination shall mean an impairment of the quality of the City water supply by sewage, industrial fluids or any other foreign substance to a degree which creates an actual hazard to the public health through the potential spread of disease.

CRITICAL LEVEL - The term critical level shall mean the marking on a vacuum breaker which determines a minimum elevation above the flood level rim of the fixture or receptacle served at which the device may be installed.

CROSS-CONNECTION - The term cross-connection shall mean any unprotected connection between any part of a water system used or intended to supply water for drinking purposes and any source or system containing water or substances that is contaminated or cannot be approved as safe, wholesome and potable for human consumption. By-pass arrangements, jumper connections, removable sections, swivel or change-over devices and other temporary or permanent devices through which or because of which "backflow" can or may occur are considered to be cross-connections.

DOUBLE CHECK VALVE ASSEMBLY - The term double check valve assembly means an assembly of at least two independently-acting, approved, spring and weight loaded check valves with resilient discs for the intended purpose of preventing back pressure backflow in a water supply line. Assembly is usually furnished with test cocks for field testing the tightness of the check valves. Some assemblies include

a “vacuum breaker” to admit atmospheric air downstream of the assembly.

DUAL CHECK VALVE(DuCV) – The term dual check or DuCV is a mechanical backflow preventer consisting of two independently acting, spring-loaded check valves. DuCV’s are not equipped with test cocks and is effective against backpressure backflow and backsiphonage but should be used to isolate only non-health hazards and is intended for use only in water service connections to single-family homes.

FIRE SPRINKLER SYSTEM - A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection and engineering standards. The installation includes one or more water supplies.

FLOOD LEVEL RIM - The edge of the receptacle from which water overflows is the flood level rim.

HAZARD - DEGREE OF - The term degree of hazard is a qualification of what potential and actual harm may result from cross-connections within a water-using facility. Establishing the degree of hazard is directly related to the type and toxicity of contaminants that could feasibly enter the public water supply water system and can be classified as either a “pollutional” (non-health) or a “contamination” (health) hazard.

HAZARD - HEALTH - The term health hazard shall mean an actual or potential threat of contamination or pollution of a physical or toxic nature to the public potable water system of the consumer’s potable water system to such a degree or intensity that there would be a danger to health.

HAZARD - PLUMBING - The term plumbing hazard shall mean a plumbing type cross-connection in a consumer’s potable water system that has not been properly protected by a vacuum breaker, air-gap separation or other device. Unprotected plumbing type cross-connections are considered to be a health hazard. They include, but are not limited to, cross-connections, to toilets, sinks, laboratories, wash trays, domestic washing machines and lawn sprinkler systems. Plumbing type cross-connections can be located in many types of structures, including homes, apartment houses, hotels and commercial and industrial establishments. Such a connection, if permitted to exist, must be properly protected by an appropriate type of cross-connection control assembly.

HAZARD - POLLUTION - The term pollution hazard shall mean an actual or potential threat to the physical properties of the water system

or the potability of the public or the consumer's potable water system, but which would not constitute a health or system hazard, as defined. The maximum degree of intensity of pollution to which the potable water system could be degraded under this definition would cause a nuisance, or be aesthetically objectionable, or could cause minor damage to the system or its appurtenances.

HAZARD - SYSTEM - The term system hazard shall mean an actual or potential threat of severe danger to the physical properties of the public or the consumer's potable water system, or of a pollution or contamination which would have a protracted effect on the quality of the potable water in the system.

HEALTH AGENCY - The term health agency shall mean the health authority having jurisdiction.

HOSPITAL - The term hospital shall mean an institution, place, building or agency which maintains and operates organized facilities for one or more persons, for the diagnosis, care and treatment of human or animal illness, including convalescence care during and after pregnancy, or which maintains and operates organized facilities for any such purpose and to which persons may be admitted for an overnight stay or longer. "Hospital" includes sanitarium, nursing home, maternity home and veterinarians.

INDUSTRIAL FLUID - The term industrial fluid shall mean any fluid or solution which may be chemically, biologically or otherwise contaminated or polluted in a form or concentration, such as would constitute a health, system, pollution or plumbing hazard if introduced into an approved water supply. This may include, but not be limited to: polluted or contaminated used waters; all types of process water and "used water" originating from public potable water system which may deteriorate in sanitary quality; chemicals in fluid form; plating acids and alkalis; circulated cooling waters connected to an open cooling tower and/or cooling waters that are chemically or biologically treated or stabilized with toxic substances; contaminated natural waters such as from wells, springs, streams, rivers, bays, seas, irrigation canals or systems, etc.; oils, gases, glycerin, paraffins, caustic and acid solutions and other liquid and gaseous fluids used industrial or other processes or for firefighting purposes.

INDUSTRIAL PIPING SYSTEM - CONSUMER'S - The term consumer's industrial piping system shall mean any system used by the customer for transmission of or to store any fluid, solid or gaseous substance other than an approved water supply. Such a system would include all pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances to produce, convey or store substances which are or may

be polluted or contaminated.

INLET - The open end of the water supply pipe through which the water is discharged into the plumbing fixture shall be the inlet.

LABORATORY - APPROVED TESTING - Reference to an approved testing laboratory shall mean the Foundation for Cross-Connection Control Research of the University of Southern California, or any other laboratory having the equivalent facilities for both the laboratory and field evaluation of the devices approved by the American Water Works Association or American Society of Sanitary Engineers.

PLUMBING OFFICIAL - The term plumbing official shall mean the individual board, department or agency established and authorized by state, county, city or other political subdivision created by law to administer and enforce the provisions of the Standard Plumbing Code as adopted or amended.

PLUMBING SYSTEM - The term plumbing system includes the water supply and distribution pipes; plumbing fixtures and traps; soil, waste and vent pipes; building drains and building sewers, including their respective connections, devices and appurtenances within the property line of the premises; and water-treating or water-using equipment.

POINT OF DELIVERY - See Service Connection.

POLLUTION - Pollution shall mean an impairment of the quality of the water to a degree which does not create an actual hazard to the public health, but which does adversely and unreasonably affect it for domestic use.

REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION DEVICE (RP) - The term approved reduced pressure principle backflow prevention device (RP) shall mean a device containing within its structure a minimum of two independently acting, approved check valves, together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve reduces the supply pressure a predetermined amount, so that during normal flow and at cessation of normal flow, the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the checks less than the supply pressure. The unit shall include tightly closing shut-off valves located at each end of the device and each device shall be fitted with properly located test cocks.

SERVICE CONNECTION - The term service connection shall mean the terminal end of the public potable water system, i.e., where the water purveyor loses jurisdiction and sanitary control over the water at its point of delivery to the consumer's water system. If a meter is installed at the end of the service connection, then the service connection shall mean the downstream end of the meter. There shall be no unprotected takeoffs from the service line ahead of any backflow prevention device located at the point of delivery to the consumer's water system.

VACUUM BREAKER - NON-PRESSURE (ATMOSPHERIC) TYPE - A vacuum breaker - non-pressure type is a vacuum breaker which is designed for use where it will not be subject to static line pressure.

VACUUM BREAKER - PRESSURE TYPE - A vacuum breaker - pressure type is a vacuum breaker designed to operate under conditions of static line pressure.

WATER - POTABLE - The term potable water shall mean the utility owner or operator of the public potable water system supplying an approved water supply to the public. The utility shall be one that is operating under a valid permit from the Department of Environmental Protection. As used herein the terms water purveyor and City of Eustis Water Department may be used synonymously.

WATER SUPPLY - APPROVED - The term approved water supply shall mean any public potable water supply which has been investigated and approved by the Florida Department of Environmental Protection. The system must be operating under a valid permit. In determining what constitutes an approved water supply, the Department of Environmental Protection has reserved final judgment as to its safety and potability.

WATER SUPPLY - AUXILIARY - The term auxiliary water supply shall mean any water supply on or available to the premises other than the purveyor's approved public potable water supply. These auxiliary waters may include water from another purveyor's public potable water supply or any natural source such as a well, spring, river, stream, etc., or "used water" or "industrial fluids". They may be polluted or contaminated or objectionable and constitute an unacceptable water source over which the water purveyor does not have sanitary control.

WATER SUPPLY - UNAPPROVED - The term unapproved water supply shall mean a water supply which has not been approved for human consumption by the health agency having jurisdiction.

WATER SYSTEM - CONSUMER'S - The term consumer's water system

shall include any water system located on the consumer's premises, whether supplied by the public potable water system or an auxiliary water supply. The system or systems may be either a potable water system or an industrial piping system.

WATER SYSTEM - CONSUMER'S POTABLE - The term consumer's potable water system shall mean that portion of the privately owned potable water system lying between the point of delivery and point of use. This system will include all pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances used to produce, convey, store or use potable water.

WATER SYSTEM - PUBLIC POTABLE - The term public potable water system shall mean any publicly or privately owned water system operated as a public utility, under a recent health permit, to supply water for domestic purposes. This system will include all sources, facilities and appurtenances between the source and the point of delivery such as valves, pumps, pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances used to produce, convey, treat or store a potable water for public consumption or use.

WATER - USED - The term used water shall mean any water supplied by a water purveyor from a public potable water system to a consumer's water system after it has passed through the point of delivery and is no longer under the control of the water purveyor.

## SECTION 7 APPLICABLE STANDARDS AND DESCRIPTIONS FOR BACKFLOW PREVENTION DEVICES

### 7.01 Applicable Standards

The following list identifies specifications or requirements of approving agencies recognized by the City of Eustis. All backflow prevention devices and condition of cross-connection control shall be in compliance with the standards set forth by one or more of the following agencies. The City reserves the right to state which standards apply if and when conflicts between standards arise.

AWWA - American Water Works Association - #C506 and manual M14.

ASSE - American Society of Sanitary Engineers.

FCCCHR of USC - University of Southern California, Foundation for Cross-Connection and Hydraulic Research (Manual of Cross-Connection Control, Ninth Edition,

SBCC - Southern Building Code Congress (Standard Plumbing Code).

7.02 Abbreviations for Protective Devices

- AG - Approved Air-Gap
- AVB - Approved Atmospheric Vacuum Breaker
- DCVA - Approved Double Check Valve Assembly
- HBVB - Approved Hose Bibb Vacuum Breaker
- PVB - Approved Pressure Vacuum Breaker
- RP- Approved Reduced Principle Backflow
- DuCV - Approved Dual Check Valve

7.03 Types and Descriptions of Backflow Prevention Devices

The following definitions apply to hazard conditions existing at a site where backflow prevention may be required.

<u>Degree of Hazard</u>	<u>Definition</u>
Low	A condition where a polluting substance may come in contact with potable water aesthetically affecting the taste, odor or appearance, but not hazardous to health (non-toxic), (e.g., pollution hazard).
Moderate - to high	A condition where a polluting substance may come in contact with potable water creating a health hazard, causing sickness or death (toxic), (e.g., system hazard, plumbing hazard, health hazard).

Table 7.1 lists the types and applications of backflow prevention devices, a brief description of each device, and typical installation conditions.

TABLE 7.1

<u>TYPE &amp; APPLICATION</u>	<u>TYPICAL DESCRIPTION</u>	<u>APPLICABLE INSTALLATION</u>
DOUBLE CHECK VALVE ASSEMBLY (FOR <u>LOW HAZARD</u> CONNECTION)	TWO INDEPENDENT CHECK VALVES, SUPPLIED WITH SHUT OFF VALVES & BALL TYPE TEST COCKS.	FOR USE ON FIRE SPRINKLER PROTECTION SYSTEMS AND CROSS CONNECTIONS SUBJECT TO BACK PRESSURE WHERE THERE IS A LOW POTENTIAL HEALTH HAZARD OR NUISANCE. CONTINUOUS PRESSURE.
AIR-GAP (FOR <u>MODERATE TO HIGH HAZARD</u> CROSS-CONNECTION).	VERTICAL SEPARATION OF 2" DIAMETER OF THE SUPPLY PIPE ABOVE VESSEL OVERFLOW RIM. SEPARATION MUST BE MIN. 1" OR GREATER.	ALL CROSS CONNECTIONS SUBJECT TO BACK PRESSURE OR BACK SIPHONAGE WHERE THERE IS A HIGH POTENTIAL HEALTH HAZARD FROM CONTAMINATION.
ATMOSPHERIC VACUUM BREAKERS ( <u>LOW HAZARD</u> )	SINGLE FLOAT AND DISC. WITH LARGE ATMOSPHERIC PORT.	CROSS CONNECTION NOT SUBJECT TO BACK PRESSURE OR CONTINUOUS PRESSURE, INSTALL AT LEAST 12" ABOVE HIGHEST OUTLET. PROTECTION AGAINST BACK SIPHONAGE ONLY.
HOSE BIBB VACUUM BREAKERS FOR RESIDENTIAL AND INDUSTRIAL HOSE SUPPLY OUTLETS.	SINGLE CHECK WITH ATMOSPHERIC VACUUM BREAKER VENT.	INSTALL DIRECTLY ON HOSE BIBB, SERVICE SINKS AND WALL HYDRANTS. NOT FOR CONTINUOUS PRESSURE.
PRESSURE TYPE VACUUM BREAKERS (FOR <u>MODERATE TO HIGH HAZARD</u> CROSS CONNECTION).	SPRING LOADED SINGLE FLOAT AND DISC. WITH INDEPENDENT 1ST CHECK. SUPPLIED WITH SHUT-OFF VALVES AND BALL TYPE TEST COCKS.	THIS VALVE IS DESIGNED FOR INSTALLATION IN A CONTINUOUS PRESSURE. POTABLE WATER SUPPLY SYSTEM 12" ABOVE THE OVERFLOW LEVEL OF THE SYSTEM BEING SUPPLIED. PROTECTION AGAINST BACK SIPHONAGE ONLY, NOT BACK PRESSURE.

TABLE 7.1 CONT'D

REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER (FOR <u>HIGH HAZARD</u> CROSS-CONNECTION.	TWO INDEPENDENT CHECK VALVES WITH INTERMEDIATE RELIEF VALVE SUPPLIED WITH SHUT OFF VALVE AND BALL TYPE TEST COCKS.	ALL CROSS CONNECTIONS SUBJECT TO BACK PRESSURE OR BACK SIPHONAGE, WHERE THERE IS A HIGH POTENTIAL HEALTH HAZARD FROM CONTAMINATION..
DUAL CHECK VALVE BACKFLOW PREVENTER (FOR <u>LOW HAZARD</u> APPLICATIONS).	TWO INDEPENDENT CHECK VALVES. CHECKS ARE REMOVABLE FOR TESTING.	CROSS-CONNECTION WHERE THERE IS A LOW POTENTIAL HEALTH HAZARD AND MODERATE FLOW REQUIREMENTS.

7.04 Typical Facilities Requiring Backflow Prevention Devices

1. All hospitals shall have an RP device installed on all the main service connections supplying potable water to such premises.
  2. Medical buildings, sanitariums, veterinarian facilities, morgues, mortuaries, autopsy facilities, nursing and convalescent homes and clinics shall have an RP or DCVA, depending upon degree of hazard, installed at the service connection. The hazard normally to be found in a facility of this type include cross-connections between the consumer's water system and contaminated or sewer connected equipment such as bedpan washers, flush valve toilets and urinals, autoclaves, specimen tanks, sterilizers, pipette tube washers, cuspidors, aspirators, autopsy and mortuary equipment.
- Note: It has been found that in this type of facility, little or no attention is given to the maintenance of air-gap separations or vacuum breakers. It is customary to bridge an air-gap separation by means of a hose section.
3. All buildings, plants or other structures having a source of unapproved water piped into such buildings, plants or other structures with the potential of being interconnected to the public supply, shall have an RP installed at the main supply line servicing their premises.
  4. All buildings, hotels, apartment houses, public and private buildings, or any other structures having unprotected cross-connections shall have an RP or DCVA, depending upon degree of hazard, installed at the service connection to any premises where multi-storied public buildings such as hotel, apartment house, office or loft building are operated or maintained if the buildings have unprotected cross-connections, sewer pumping

facilities, auxiliary water supplies, or other like sources of contamination which could create a potential hazard to the public water system. Also, an approved backflow prevention device should be installed at the service connection to any premises where there are existing cross-connections or where potential cross-connections exist or where it is expected that the consumer may make piping or equipment changes which would result in the installation of a cross-connection.

5. All water front facilities and industries shall have an RP or DCVA, depending upon the degree of hazard, installed at their service connection to any premises where there are piers, docks or other water front facilities or industries or where water from a river, stream, irrigation, ditch or canal, lake, etc., is available to be used on the premises, except that backflow protection may not be required on facilities which do not have docking facilities, or which do not have outlets available for supplying water to docks or facilities, or which do not have outlets available for supplying water to docks of facilities which have not been used for such auxiliary water supplies as irrigation, fire protection, air conditioning, cooling, swimming pool supply or other such purpose.
6. All manufactures of chemicals which are toxic may be required at the discretion of the water purveyor to install an RP.
7. All sewage treatment plants shall have a RP installed on main potable water service lines serving such plants.
8. Dairies and cold storage plants shall have an RP or DCVA, depending upon the degree of hazard, installed on the service connection to any premises where a dairy, creamery, ice cream plant, cold storage, or ice manufacturing plant is operated or maintained provided such a plant has on the premises an auxiliary water supply, industrial fluid system, sewer handling facilities or other similar source of contamination which if cross-connected to, would create a hazard to the public system. The hazards normally to be found in a plant of this type include cross-connections between the consumer's waste system and reservoirs, cooling towers and circulating system which may be heavily contaminated with bird droppings, vermin, algae, bacterial slimes, or toxic water treatment compounds.
9. Schools and colleges shall have an DCVA or RP installed at the service connection where water is used to supply chemical, bacteriological and biological laboratories; or where the water is used to supply separate irrigation systems; or where there are unprotected sewer cross-connections.

Note: This hazard is critical because little or no attention is given to the maintenance of vacuum breakers and frequently they are removed from the line; steam generating facilities and lines are frequently

contaminated with boiler compounds such as pentachlorophenol, cyclohexylamine, etc. A very particular hazard is the possibility of steam getting back into the domestic system, causing a health hazard.

10. In commercial car washing installations, potable make-up water lines to reclaim water pits shall have an AG separation. All potable water connections to fluids such as bug cleaners, tire cleaners, and wax and soap solution make-up tanks shall have an AG separation. If this is not possible, due to the design of equipment, a RP shall be installed on the main water service connection.
  11. All buildings or premises where security requirements or other prohibiting restriction make it impossible or impractical to make a complete inside cross-connection survey, the public water system shall be protected against backflow from the premises or building by an RP installed on the main service connection serving the building or premises.
- Note: Any device, equipment or situation not covered by this cross-connection policy where water is connected or used, which may constitute a potential health hazard, will be handled at the discretion of the water purveyor or his authorized agent.
12. Customers with reclaimed water service shall receive public education at the time of initial connection to the reuse system and annually after the reuse system is placed into operation.

#### 7.05 Typical Plumbing Arrangements Requiring BFPD

Note references to SBCC, Standard Plumbing Code (SPC)

1. Fixture inlets or Valved Outlets with hose attachments, which may constitute a cross-connection, shall be protected by the proper approved vacuum breaker (AVB, HBVB, etc.) installed at least six (6) inches above the highest point of usage and located on the discharge side of the last valve. Fixtures with integral vacuum breakers manufactured as a unit may be installed in accordance with their approved requirements. (SPC Sec. 1204.3.4).
2. Industrial Fluid or Processes Water - Potable water pipelines connected to industrial piping systems or to equipment containing industrial fluid, sewage, used or processed water, or any other potentially contaminated liquid shall be protected by installing an RP in the interconnecting lines or by an AG separation.
3. Air Condition Cooling Tower - Potable water inlet shall have an AG separation of twice the inside diameter of the inlet line or a minimum of two inches above the flood level rim.
4. Aspirators and Ejectors - Shall have an AVB or PVB, depending upon the degree of hazard, on the faucet from which these devices

- are attached or operated. (SPC Sec. G104.6).
5. Automatic Film Processors - Potable water lines connected directly to an automatic film processor shall be protected by an AG or a DCVA.
  6. Bath tub with Hose Attachments - shall have an AVB at faucet.
  7. Bedpan Washer - Shall have an AVB or PVB installed in accordance with the Standard Plumbing Code. (SPC Sec. G104.6).
  8. Boiler Connection - Potable water connection to boiler feed water system which contains conditioning chemicals shall either be made through an AG at make-up tank, or have an RP, or DCVA, depending upon the degree of hazard. Feed connections to steam and hot water heating boilers, heat exchangers, etc. which do not contain chemical additives shall have either an AG or DVCA. (SPC Sec. 1204.3.5).
  9. Booster Pumps - All booster pumps shall be provided with a low pressure cut-off unless other acceptable provisions are made to prevent the creation of low or negative pressures in the piping system. (SPC Sec. 1211.6).
  10. Colonic Irrigators or Douche Attachments - Shall have an AVB installed. (SPC Sec. G104.7).
  11. Dark Rooms (Photographic) - All threaded faucets shall be protected with an AVB, PVB, or HBVB.
  12. Dishwashing Machine - Shall be connected with an AVB or PVB on both hot and cold water supply lines in accordance with the Standard Plumbing Code. (SPC Sec. 915,1101.2, 1204.1).
  13. Dip Tanks and Vats - Potable water inlet shall have an AG separation twice the inside diameter of the inlet or a minimum of two inches above the flood level rim.
  14. Garbage Disposer - Potable water supply lines connected directly to garbage disposer shall be equipped with an AVB, PVB, or BPw/AV. (SPC Sec. 912.1).
  15. Drinking Fountains - Shall have an AG separation. (SPC Sec. 913.2).
  16. Fire Sprinkler Drains - Shall have an AG separation to the sewer.
  17. Flushing Floor Drains - Shall have an AVB installed. (SPC Sec. G104.6).
  18. Flush Valve Water Closets, Urinals, and Bidets - Shall have a vacuum breaker installed in accordance with the Standard Plumbing Code. (SPC Sec. 1204.3.1).
  19. Foot and Sitz Bath - Shall have an AG separation or an AVB installed. (SPC Sec. G104.7).
  20. Hydrotherapy Baths - Shall have an AVB installed at water connection. (SPC Sec. G104.7).
  21. Janitors, Mops or Slop Sink - With threaded hose faucet shall be equipped with an AVB before faucet.
  22. Lawn Sprinkler Systems - Shall have an AVB, PVB, or DVCA

- installed. (SPC Sec. 1204.3.3).
23. Pipette Washer - Shall have an AVB installed or AG separation installed on faucet.
  24. Private Wells - Shall not be interconnected unless the public supply is protected by an RP at the service connection.
  25. Potable Water Make-Up Lines - To chill water loops, heating loops, purge units, condensers, converters, and condensate tanks should be equipped with BP w/IAV, DCVA, or RP, depending upon degree of hazard.
  26. Reuse Residential – Shall have a Dual Check Valve installed at the potable water meter.
  27. Reuse Commercial – Shall have a RP installed at the potable water meter.
  28. Serrated Faucets - Shall be equipped with an AVB, PVB at the faucet. If goose neck faucet is used “laboratory faucet type vacuum breaker” is acceptable. (SPC G104.6).
  29. Shampoo Basin Hose Rinse - Shall have an AVB installed.
  30. Sinks and Bath top Faucets - Shall have an AG separation above flood level rim.
  31. Sterilizers - Shall have an AG separation or AVB or PVB installed.
  32. Stills - Shall have an AG separation.
  33. Swimming Pool Fill Line - Shall have an AG separation above the flood level rim or a DVCA.
  34. Temporary Fire Hydrant Connection- Shall have an RP installed at the hydrant.
  35. Wash-Up Sinks with Threaded Faucets - Shall have an AVB or HBVB installed.
  36. Wash-down Hose Faucet - Shall have an AVB, PVB or HVBV installed on faucet.
  37. Washing Machine Drain Lines - Shall have an AG separation to sewer. (SPC Sec. 919).
  38. Water Supply Inlets - In pits, tanks, trenches, tubs, vats, or any other place that could become flooded with contaminated liquids shall have an AG separation above the flood level rim.
  39. Water Operated Presses, Elevators, or Other Similar Pressure Producing Equipment - Shall have an RP installed.
  40. X-Ray Developing Tank - Shall have an AG separation or an AVB or PVB.
  41. Alternate Water Supply on Residential Property – Shall have a DuCV at the potable water meter.

Note: Any device, equipment, or situation not covered by this cross-connection policy, which may constitute a potential health hazard, will be examined for appropriate treatment by the Water Department or authorized agent.

## SECTION 8 TESTING OF BACKFLOW PREVENTERS

### 8.01 General Requirements

As part of a complete cross-connection control program, the City of Eustis requires the testing of reduced pressure backflow prevention devices (RP), double check valve assemblies (DCVA) and pressure vacuum breakers (PVB) with a thorough inspection and operational test at least once a year. Proper field test procedures with calibrated gage equipment must be used by certified personnel. The customer - user will have these devices tested by certified private contractor with the results forwarded to the City of Eustis Water Department.

These inspections and tests and any maintenance or repair required as a result of the test, shall be at the expense of the customer - user and shall be performed by the device's manufacturer's representative, certified licensed plumber or by a certified device tester.

All devices, failing to meet latest performance standards set forth by the American Water Works Association (AWWA 506), American Society of Sanitary Engineers (ASSE 1013), or the Foundation for Cross-Connection Control at the University of Southern California (Manual of Cross-Connection Control), shall be repaired and retested promptly. Devices repeatedly found not to meet the Standards are to be replaced with new devices.

If such testing indicates wear or other malfunctions, the devices shall be overhauled. Such an overhaul should consist of the replacement of all seats, diaphragms, gaskets, etc., which are subject to wear, and any other parts found to be worn or otherwise in questionable condition.

### 8.02 Parallel Installation

All backflow prevention devices with test cocks are required to be tested once per year. Testing requires a water shutdown usually lasting five (5) to twenty (20) minutes. For facilities that require an uninterrupted supply of water, and when it is not possible to provide water service from two separate meters, provisions shall be made for a "parallel installation" of backflow prevention devices.

During testing, one device is left on while the other is being tested. Usually the two devices are sized one device size smaller than the

service line, on 2-inch device or two 1 1/2 inch devices. One 8 inch device or two 6 inch devices.

The City of Eustis Water Department will not accept an unprotected bypass around a backflow preventer when the device is in need of testing, repair or replacement.

Installation requiring continuous service and a parallel installation of backflow prevention devices listed as follows:

1. Aircraft and Missile Plants.
2. Automotive Plants.
3. Auxiliary Water Systems
  - a. Private Water Systems
  - b. "Used Water" and "Industrial Fluids"
4. Beverage Bottling Plants.
5. Breweries.
6. Buildings - Hotels, apartment houses, public and private buildings or any other structures having unprotected cross-connections.
7. Canneries, Packing Houses, and Reduction Plants.
8. Chemical Plant - manufacturing, processing, and compounding or treatment.
9. Hospitals, medical buildings, sanitariums, morgues, mortuaries, autopsy facilities, nursing and convalescent homes and clinics.
10. Laundries and dye work.
11. Paper and paper product plants.
12. Power plants.
13. Restricted, classified or other closed facilities.
14. Schools and colleges.

### 8.03 Records

The water purveyor will notify the customer when tests are to be performed and results of the tests shall be supplied to the customer. A full report shall be made available of any maintenance on repairs to backflow prevention devices and are to be routed promptly to the City of Eustis Cross-Connection Control Program.

Copies of written reports, summaries or other communications relating to this cross-connection control program or sanitary surveys of the system conducted by the system itself, by a private consultant or by any Local, State or Federal agency shall be

maintained by the Utility Department for a period of not less than ten (10) years.

Each CWS (Community Water System) serving more than 10,000 persons shall prepare and submit cross-connection control program annual reports. The first annual report shall cover calendar year 2016, and subsequent annual reports shall cover each calendar year thereafter. These reports shall be prepared using Form 62-555-900(13), Cross-Connection Control Program Annual Report, effective 5-5-14, which is incorporated herein by reference and which is available as described in Rule 62-555.900, F.A.C. The reports shall be submitted to the appropriate Department of Environmental Protection district office or Approved County Health Department within three months after the end of the calendar year covered by the report.

#### 8.04 Testers

To ensure continued satisfactory operation of a backflow prevention device, testing shall be performed by individuals who are certified and understand the design and intended operation of the device. Only certified device testers will be accepted by the City of Eustis Water Department, to perform testing of backflow prevention devices. The contractor or individuals who are certified must provide the City of Eustis Water Department with a valid Backflow Prevention Technician certification. A program to train individuals in the testing of backflow preventers is available regionally and nationally. The water purveyor will have the necessary information on how to register and participate in these programs.

## SECTION 9 RESULTS OF NON-COMPLIANCE

A letter listing all potential cross-connections found during the inspection will be sent to the owner or authorized agent of the owner of the building or premises, stating that correction should be made and setting a reasonable time for compliance. Upon failure of the owner or authorized agent of the owner of the building or premises to have the defects corrected by the specified time and the water purveyor may cause the water service to the building on premises to be terminated.

The water purveyor may cause discontinuance of water service if a reduced pressure backflow prevention device has been by-passed or failed to be properly maintained as required by the City of Eustis and/or policy statements contained in this manual. In general, violations involving moderate - to - high degrees of hazard must be corrected immediately. Violations involving low degrees of hazard shall be corrected within sixty (60) days of the date of deficiency was brought to the attention of the customer-user. If discontinuance of service is required, the matter shall be simultaneously brought to the attention of the City Manager.

## SECTION 10 INSTALLATION

Manufacturer's installation instructions must be followed to ensure proper operation and to protect the equipment's warranty. General installation guidelines are as follows:

1. The device should be installed in a horizontal position and have at least 12" between the bottom of the device and final grade of floor.
2. Lateral clearance around the device must be provided to facilitate testing, maintenance and replacement.
3. Two devices should be installed in parallel for any facility that must have uninterrupted flow during device testing or repair (e.g., hospitals).
4. Though not recommended, devices may be installed in pits that are well drained; no part of a device should ever be under water.
5. If a device is installed inside a building, a floor drain is helpful to eliminate spillage caused by testing or flushing.
6. Since the relief valve on a RP will periodically drip or spit and may dump, the relief vent may be fitted with a drain line if spillage is objectionable or hazardous (e.g., electrical hazards). The end of the drain line must terminate 12" above ground or flood level and be clearly visible and accessible.
7. The device should be protected against freezing.

8. Shut-off valves should be of the OS and Y type.
9. The assembled piping should be thoroughly flushed before installing the device.
10. The device should be adequately supported.

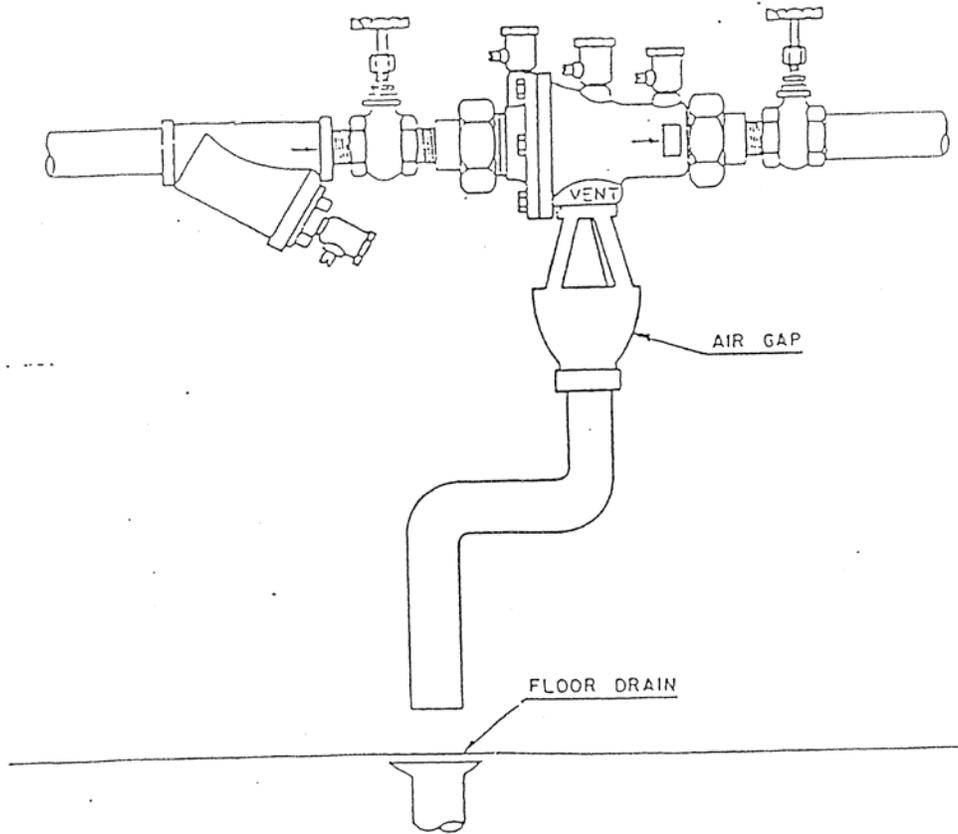
## CONSTRUCTION OF STANDARDS

### Types of Backflow Prevention Devices

The following pages illustrate the various types of backflow prevention devices and the typical methods of installation (outdoor).

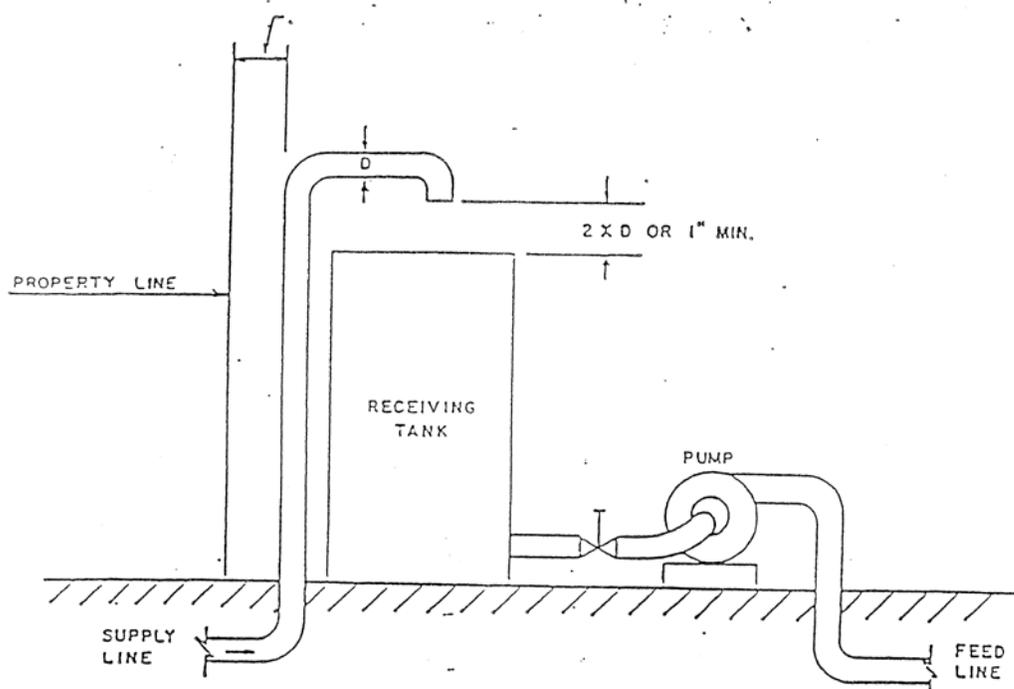
Backflow prevention devices installed indoors will vary in the method of installation based on location and configuration of the existing or proposed piping system.

#### 10.1 Diagram of Reduced Pressure Device



TYPICAL INDOOR REDUCED PRESSURE  
BACKFLOW PREVENTER INSTALLATION

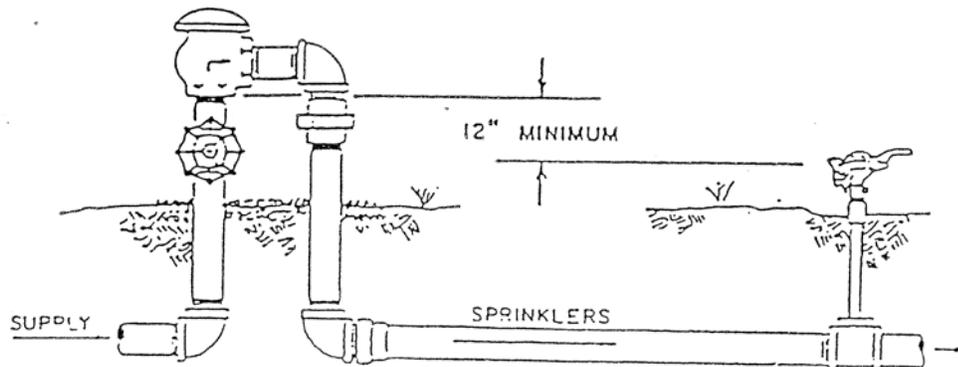
## 10.2 Air-Gap Separation



NOTE:

1. An air-gap separation means the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level or overflow rim of the receptacle.
2. The “approved air gap separator” shall be at least double the diameter of the supply pipe measured vertically above the overflow rim of the vessel and in no case shall the gap be less than one (1) inch in diameter.

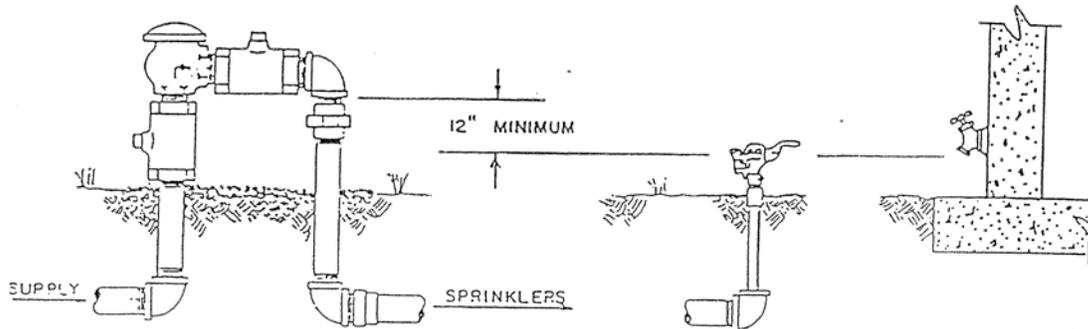
10.3 Atmospheric Vacuum Breaker (A.V.B.)



NOTE:

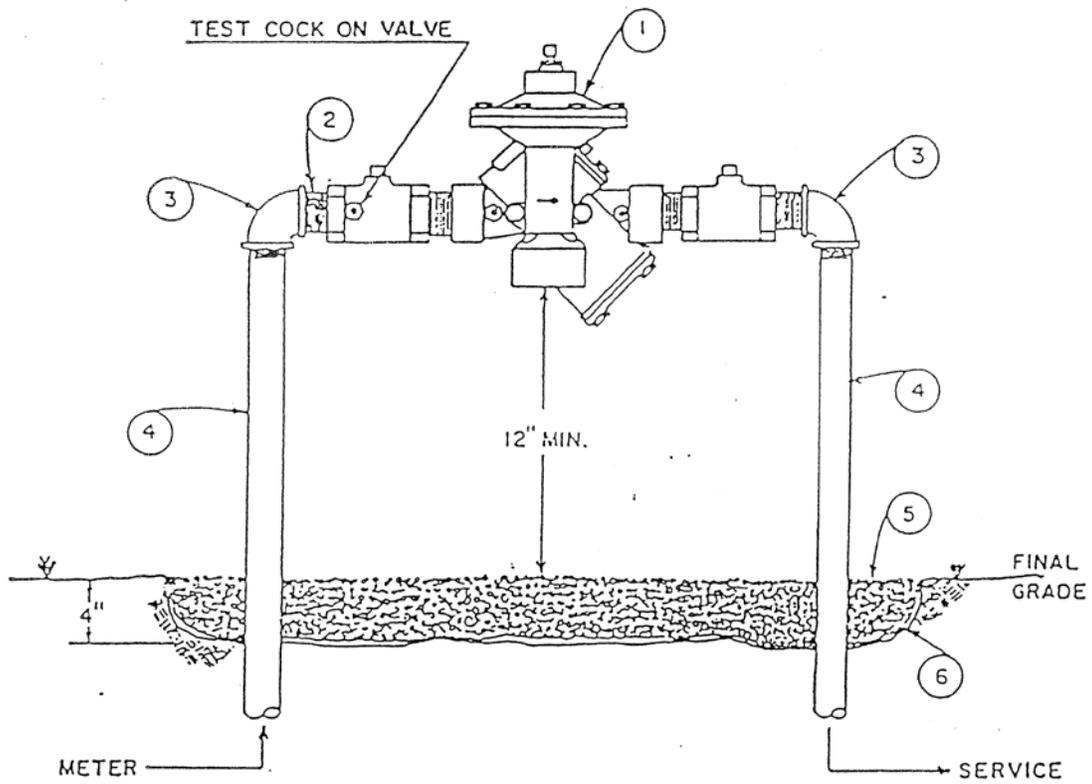
1. The atmospheric vacuum breaker cannot be installed where it will be subjected to back pressure. It can only provide protection against back-siphonage of non-toxic pollutants.
2. Each device shall be installed in an accessible location to facilitate inspection and servicing.
3. Each A.V.B. shall be installed downstream of the last shut-off valve and at least 12 inches above the highest sprinkler head of outlet. (No valves may be located downstream of the device).
4. Under no circumstances should the A.V.B. be installed where it will be under continuous operating pressure for more than 12 hours in any 24-hour period.

10.4 Pressure-Type Vacuum Breaker (P.V.B.)



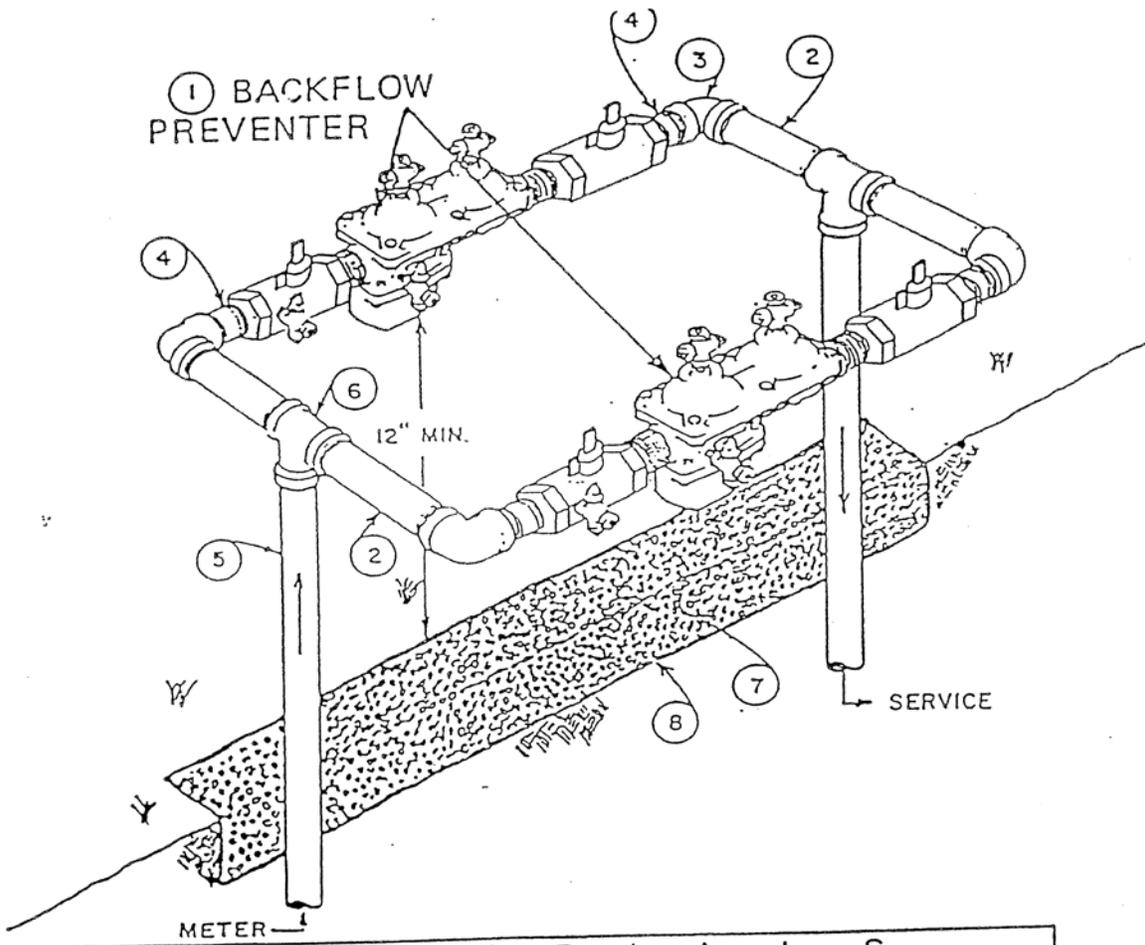
- NOTE:
1. The pressure vacuum breaker (P.V.B.) cannot be installed where it will be subjected to back-pressure. It provides protection against back-siphonage of both pollutants and contaminants.
  2. Each P.V.B. shall be installed in an accessible location to facilitate inspection and servicing.
  3. Each P.V.B. shall be installed on the main line to the irrigation system and at least 12 inches above the highest sprinkler head or outlet. (Valves may be located downstream from the device).

10.5 Double Check or Reduced Pressure Backflow Preventer  
 Single Service: 3/4", 1", 1 1/2", 2"



NOTE: Installation shown above is for a 2" service. Change piping materials accordingly for service size.

10.6 Double Check or Reduced Pressure Backflow Preventer  
Dual Service: 3/4", 1", 1 1/2", 2"

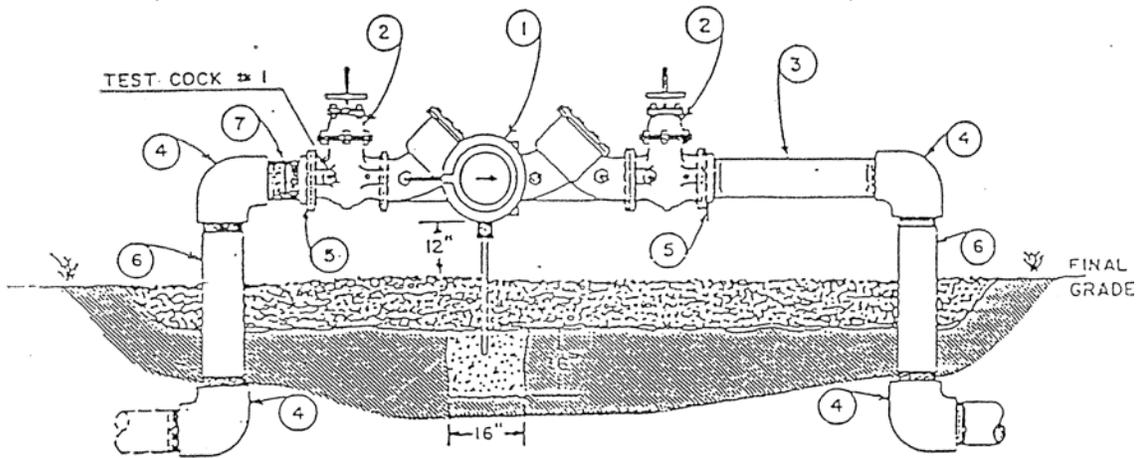


M A T E R I A L S			
ITEM	QUANT.	DESCRIPTION	
1	2	2"	BACKFLOW PREVENTER ASSEMBLY
2	4	2" X 6"	NIPPLES - GALVANIZED or PVC
3	4	2" X 90°	ELBOWS - GALVANIZED or PVC
4	6	2" X 4"	NIPPLES - GALVANIZED or PVC
5	2	2"	RISER - GALVANIZED
6	2	2"	TEES - GALVANIZED
7	*		PEA GRAVEL
8	*		PLASTIC LINER

NOTE: Installation shown above is for a 2" service. Change piping materials accordingly for service size.

10.7 Reduced Pressure Backflow Preventer

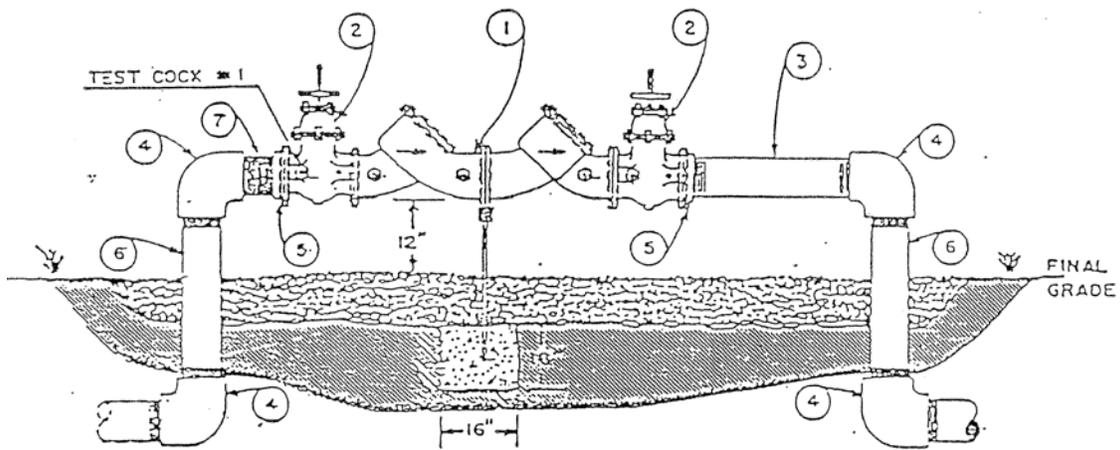
Single Service: 3", 4"



M . A T E R . I A L S			
ITEM	QUANT.	DESCRIPTION	
1	1	3", 4"	VALVE, REDUCED PRESSURE
2	2	3", 4"	VALVE, GATE, C.I., F-F
3	1	3" 4"	NIPPLE, GALV. (12" LONG) (OPT.)
4	4	3", 4"	ELBOW, GALV. - 90°
5	2	3", 4"	FLANGE, STEEL PIPE, SCREW-TYPE
6	2	3", 4"	PIPE, GALV. (42" LONG)
7	1	3", 4"	NIPPLE, GALV. (6" LONG)

NOTE: Field adjust and cut Item 6 to the proper length.

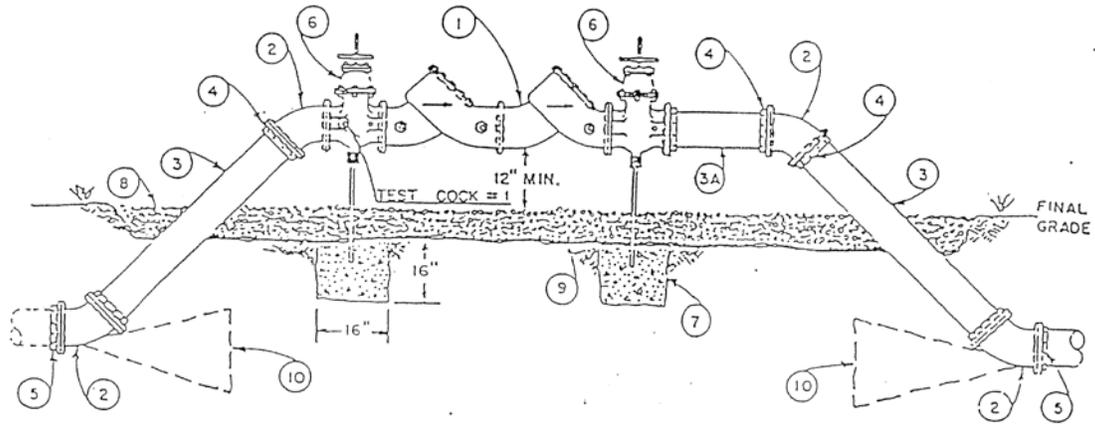
10.8 Double Check Backflow Preventer  
Single Service: 3", 4"



M. A T E R . I A L S		
ITEM	QUANT.	D. E S C R I P T I O N
1	1	3", 4" VALVE, DOUBLE CHECK
2	2	3", 4" VALVE, GATE, C.L., F-F
3	1	3", 4" NIPPLE, GALV. (12" LONG) (OPT.)
4	4	3", 4" ELBOW, GALV. - 90°
5	2	3", 4" FLANGE, STEEL PIPE, SCREW-TYPE
6	2	3", 4" PIPE, GALV. (42" LONG)
7	1	3", 4" NIPPLE, GALV. (6" LONG)

NOTE: Field adjust and cut Item 6 to the proper length.

10.9 Double Check Backflow Preventer  
Single Service: 6", 8"

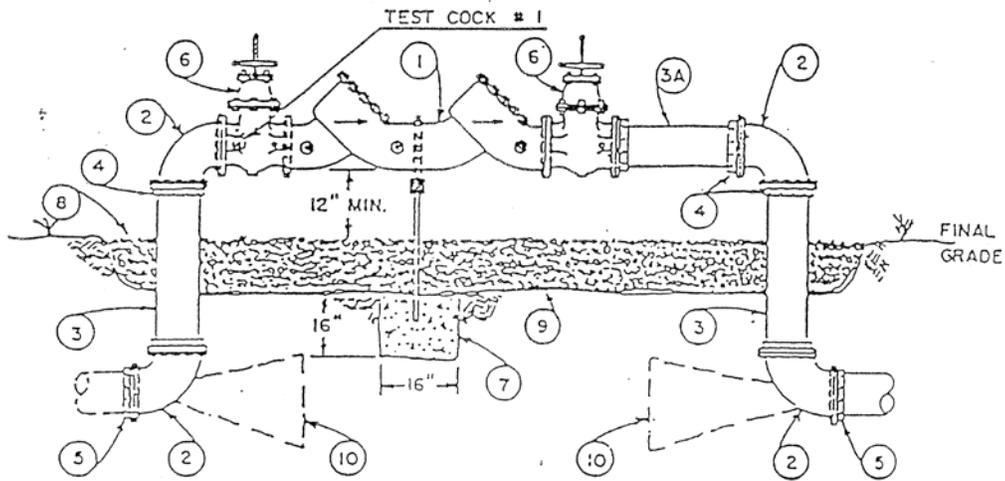


M A T E R I A L S		
ITEM	QUANT.	DESCRIPTION
1	1	6", 8" VALVE, DOUBLE CHECK
2	4	6", 8", BEND-45° F-F
3	2	6", 8" ADAPTER, C.I. (72" LONG) F-PE
3A	1	6", 8" ADAPTER, C.I. (24" LONG) F-PE (OPT.)
4	3	6", 8" ADAPTER, FLANGE, D.I.P.
5	2	6", 8" ADAPTER, FLANGE, P.V.C. (DR-18)
6	2	6", 8" VALVE, GATE, C.I., F-F
7	1 or 2	2" IRON PIPE/CONCRETE FOUNDATION
8	*	PEA GRAVEL
9	*	PLASTIC LINER
10	2	REACTION BLOCK

NOTE: Field adjust and cut Item 3 to the proper length.

\* Do not interchange Items 4, 8, 5.

10.10 Double Check Backflow Preventer  
Single Service: 6", 8"



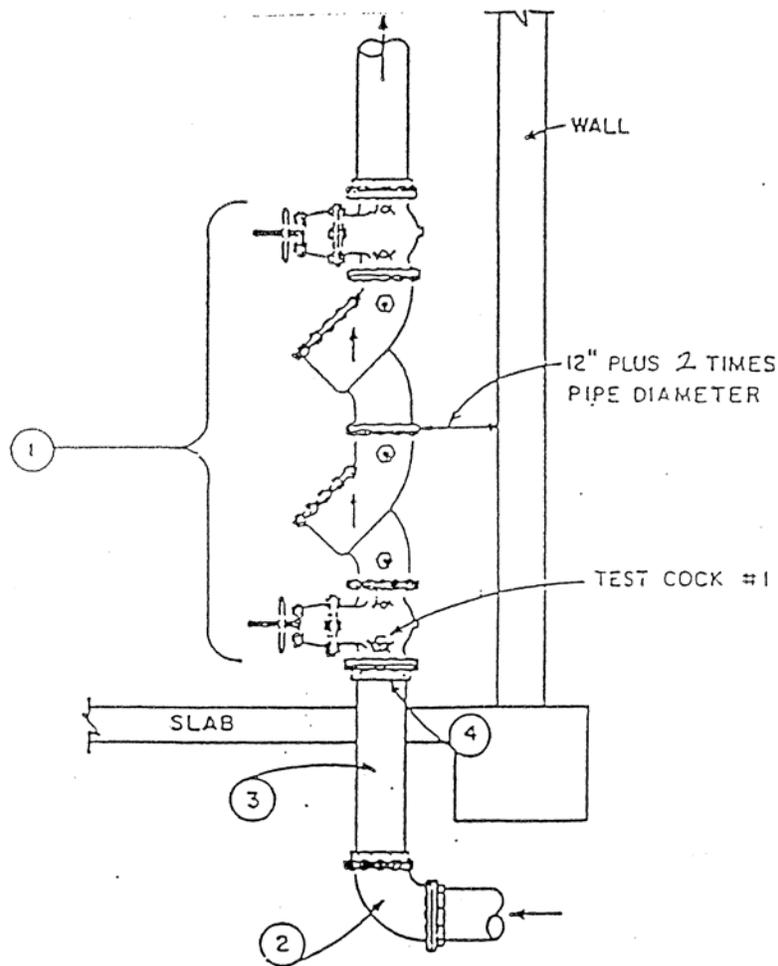
M A T E R I A L S			
ITEM	QUANT.		DESCRIPTION
1	1	6", 8"	VALVE, DOUBLE CHECK
2	4	6", 8"	BEND-90° F-F
3	2	6", 8"	ADAPTER, C.I. (48" LONG) F-PE
3A	1	6", 8"	ADAPTER, C.I. (24" LONG) F-PE (OPT.)
4	3	6", 8"	ADAPTER, FLANGE, D.I.P.
5	2	6", 8"	ADAPTER, FLANGE, P.V.C. (DR-18)
6	2	6", 8"	VALVE, GATE, C.I., F-F
7	1	2"	IRON PIPE/CONCRETE FOUNDATION
8	*		PEA GRAVEL
9	*		PLASTIC LINER
10	2		REACTION BLOCK

NOTE: Field adjust and cut Item 3 to proper length.

\* Do not interchange Items 4, 8, 5.

\* This type of construction is designed for limited working area.

10.11 Double Check Backflow Preventer  
 Single Service: 4", 6", 8"  
 Vertical Installation

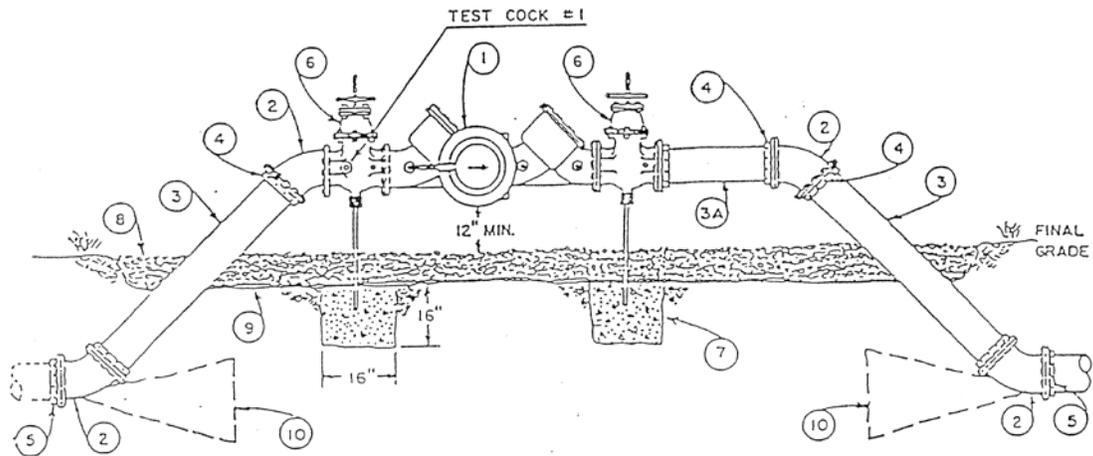


M A T E R I A L S		
ITEM	QUANT.	DESCRIPTION
1	1	4", 6", 8" DOUBLE CHECK VALVE ASSEMBLY
2	1	4", 6", 8" BEND-90° FLANGE - FLANGE
3	*	4", 6", 8" PIPE, DUCTILE IRON
4	1	4", 6", 8" ADAPTER, FLANGE, D.I.P.

NOTE: Minimum clearance around device - 12" + 3 times pipe diameter.

This type of construction is designed for limited working area. (Fire Sprinkler Systems).

10.12 Reduced Pressure Backflow Preventer  
Single Service: 6", 8"

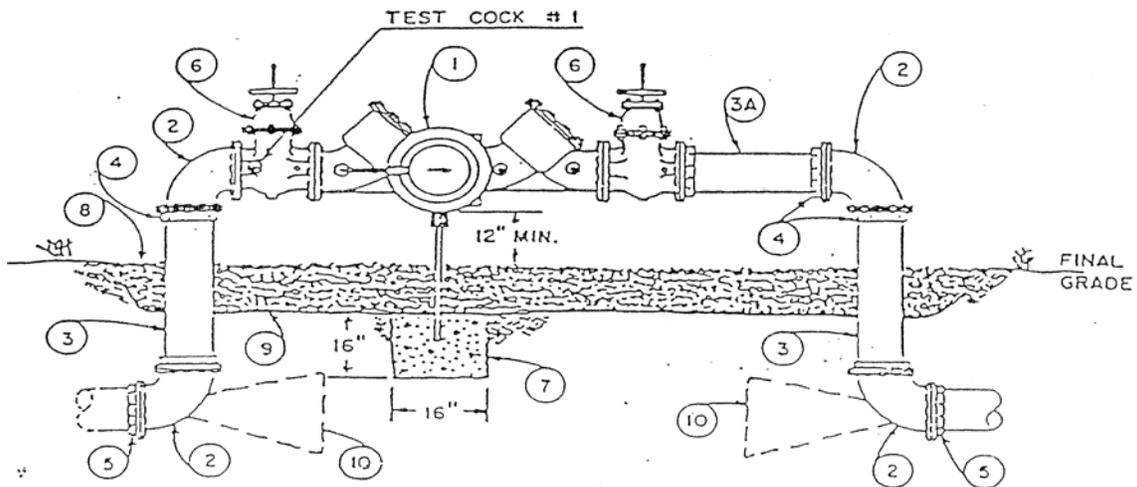


M A T E R I A L S			
ITEM	QUANT.	DESCRIPTION	
1	1	6", 8"	VALVE, REDUCED PRESSURE PRINCIPLE
2	4	6", 8"	BEND-45° F-F
3	2	6", 8"	ADAPTER, C.I. (96" LONG) F-PE
3A	1	6", 8"	ADAPTER, C.I. (24" LONG) F-PE (OPT.)
4	3	6", 8"	ADAPTER, FLANGE, D.I.P.
5	2	6", 8"	ADAPTER, I-LANGE, P.V.C. (DR-18)
6	2	6", 8"	VALVE, GATE, C.I., F-F
7	1 or 2	2"	IRON PIPE/CONCRETE FOUNDATION
8	*		PEA GRAVEL
9	*		PLASTIC LINER
10	2		REACTION BLOCK

NOTE: Field adjust and cut Item 3 to the proper length.

\* Do not interchange Items 4, 8, 5.

### 10.13 Reduced Pressure Backflow Preventer Single Service: 6", 8"



M A T E R I A L S			
ITEM	QUANT.		DESCRIPTION
1	1	6", 8"	VALVE, REDUCED PRESSURE PRINCIPLE
2	4	6", 8"	BEND-90° F-F
3	2	6", 8"	ADAPTER, C.I. (48" LONG) F-PE
3A	1	6", 8"	ADAPTER, C.I. (24" LONG) F-PE (OPT.)
4	3	6", 8"	ADAPTER, FLANGE, D.I.P.
5	2	6", 8"	ADAPTER, FLANGE, P.V.C. (DR-18)
6	2	6", 8"	VALVE, GATE, C.I., F-F
7	1	2"	IRON PIPE/CONCRETE FOUNDATION
8	*		PEA GRAVEL
9	*		PLASTIC LINER
10	?		REACTION LINER

NOTE: Field adjust and cut Item 3 to the proper length.

\* Do not interchange Items 4, 8, 5.

\* This type of construction is designed for limited working area.

## SECTION 11 TESTING PROCEDURES

### Test Equipment

For field testing of reduced pressure principle backflow preventers and double check valve assemblies, a differential pressure test gauge is utilized having a 0 to 15 psi range and a working pressure of 500 psi. Appropriate length of hoses with necessary fittings accompany the test gauge. Several manufactured test kits are commercially available that incorporate the differential gauge, hoses, and fittings and are packaged for ease of portability and come with protective enclosures or straps for hanging. Calibrated water columns are commercially available that are portable and come with carrying cases.

It is important that all test equipment be periodically checked for calibration.

### Pressure Vacuum Breaker

(Figure 38)

Field testing of a pressure vacuum breaker involves testing both the internal spring loaded soft seated check valve as well as testing the spring loaded air inlet valve. The testing must be performed with the device pressurized and the air inlet closed. The number 2 shut-off valve must also be closed and the air inlet valve canopy removed.

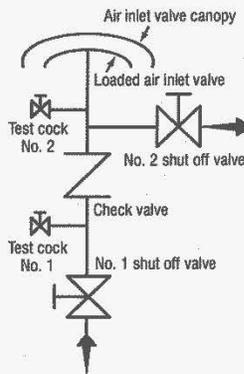
#### Method 1

Using a differential pressure gauge

**Test 1** Test the internal check valve for tightness of 1 psid in the direction of flow.

1. With the valve body under pressure, (number 2 shut-off valve closed and

FIGURE 38.



- number 1 shut-off valve open) bleed test cocks number 1 and number 2.
2. Hook up the high pressure hose to number 1 test cock and the low pressure hose to number 2 test cock.
3. Bleed the high pressure hose, and low pressure hose, in that order, and close the test kit needle valves slowly.
4. Record the differential pressure on the gauge. A reading of 1 psid is acceptable to insure a tight check valve.

**Test 2** Test the air inlet valve for a breakaway of 1 psi.

1. Connect the high pressure hose to test cock number 2, and bleed the high pressure hose.
2. Shut off number 1 shut-off valve.
3. Slowly open the bleed valve of the test kit, and observe and record the psi when the air inlet poppet opens. This should be a minimum of 1 psi. Restore the valve to normal service.

#### Method 2

Using a water column sight tube and 90 degree elbow fitting with bleed needle

**Test 1** Test the internal check valve for tightness of 1 psid in the direction of flow.

1. Assemble sight tube to test cock number 1. Open test cock and fill the tube to a minimum of 36-inches of water height.
2. Close number 1 shut-off valve.
3. Open test cock number 2. The air inlet valve should open and discharge water through number 2 test cock.
4. Open number 1 test cock. The sight tube level of water should drop slowly until it stabilizes. This point should be a minimum of 28-inches of water column which equals 1 psi.

**Test 2** Test the air inlet valve for a breakaway of 1 psi.

1. Assemble sight tube to test cock number 2. Open test cock number 2 and fill the tube to a minimum of 36-inches of water height.
2. Close number 1 shut-off valve.
3. Bleed water slowly from the number 2 test cock bleed needle and observe the water column height as it drops.
4. At the point when the air inlet valve pops open, record the height of the water column. This point should be a minimum of 28-inches of water column which equals 1psi.

Restore the valve to normal service.

### Reduced Pressure Principle Backflow Preventer

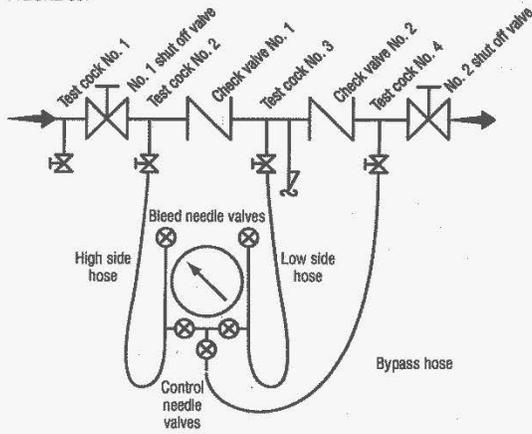
(Figure 39)

Field testing of a reduced pressure principle backflow preventer is accomplished utilizing a differential pressure gauge. The device is tested for three optional characteristics: i.e., (1) the first check valve is tight and maintains a minimum of 5 psi differential pressure, (2) the second check valve is tight against backpressure and (3) the relief valve opens at a minimum of 2 psi below inlet supply pressure. Testing is performed as follows:

**Step 1** Test to insure that the first check valve is tight and maintains a minimum pressure of 5 psi differential pressure.

1. Verify that number 1 shut-off valve is open. Close number 2 shut-off valve. If there is no drainage from the relief valve it is assumed that the first check is tight.
2. Close all test kit valves.
3. Connect the high pressure hose to test cock number 2.
4. Connect the low pressure hose to test cock number 3.
5. Open test cocks number 2 and number 3.
6. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
7. Open the low side bleed needle valve on test kit bleeding air from the low hose. Close the low side bleed needle valve. Record the differential gauge pressure. It should be a minimum of 5 psid.

FIGURE 39.

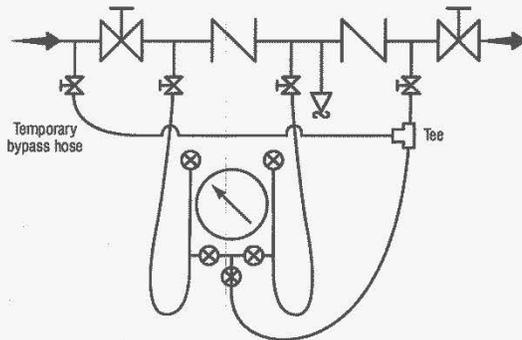


Step 2 Test to insure that the second check is tight against backpressure. (Figure 40)

1. Leaving the hoses hooked up as in the conclusion of Step 1 above, connect the bypass hose to test cock number 4.
2. Open test cock number 4, the high control needle valve and the bypass hose control needle valve on the test kit. (This supplies high

pressure water downstream of check valve number 2.) If the differential pressure gauge falls off and water comes out of the relief valve, the second check is recorded as leaking. If the differential pressure gauge remains steady, and no water comes out of the relief valve, the second check valve is considered tight

FIGURE 40.



3. To check the tightness of number 2 shut-off valve, leave the hoses hooked up the same as at the conclusion of Step 2 above, and then close test cock number 2. This stops the supply of any high pressure water downstream of check valve number 2. If the differential pressure gauge reading holds steady, the number 2 shut-off valve is recorded as being tight. If the differential pressure gauge drops to zero, the number 2 shut-off valve is recorded as leaking.

With a leaking number 2 shut-off valve, the device is, in most cases, in a flow condition and the previous readings taken are invalid. Unless a non-flow condition can be achieved, either through the operation of an additional shut-off downstream, or the use of a temporary compensating bypass hose, accurate test results will not be achieved.

Step 3 To check that the relief valve opens at a minimum pressure of 2 psi below inlet pressure.

1. With the hoses hooked up the same as at the conclusion of Step #2 (3) above, slowly open up the low control needle valve on the test kit and record the differential pressure gauge reading at the point when the water initially starts to drip from the relief valve opening. This pressure reading should not be below 2 psid.

This completes the standard field test for a reduced pressure principle backflow preventer. Before removal of the test equipment, the tester should insure that he opens number 2 shut-off valve thereby reestablishing flow. Also, the test kit should be thoroughly drained of all water to prevent freezing by opening all control needle valves and bleed needle valves.

All test data should be recorded on appropriate forms. (Ref: sample Page 45)

Note: The steps outlined above may vary in sequence depending upon local regulations and/or preferences.

## Double Check Valve Assemblies

(Figure 41)

Some field test procedures for testing double check valve assemblies require that the number 1 shut-off valve be closed to accomplish the test. This procedure may introduce debris such as rust and tuberculin into the valve that will impact against check valve number 1 or number 2 and compromise the sealing quality. This potential problem should be considered prior to the selection of the appropriate test method.

Two test methods, one requiring closing of the number 1 shut-off valve, and one without this requirement are presented below:

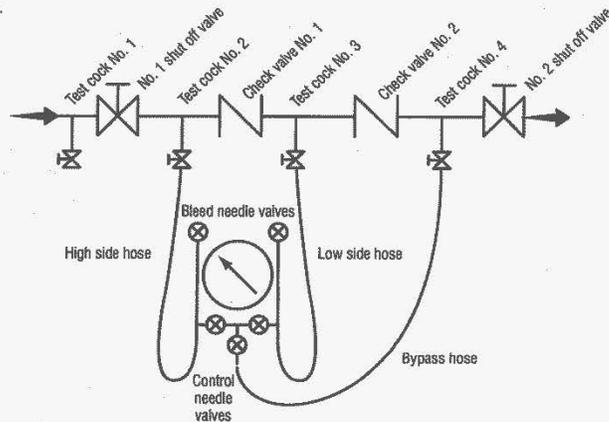
### Method 1

Utilizing the differential pressure gauge and not shutting off number 1 shut-off valve. Figure 41)

#### Step 1 checking check valve number 1

1. Verify that the number 1 shut-off is open. Shut off number 2 shut-off valve.
2. Connect the high hose to test cock number 2.
3. Connect the low hose to test cock number 3.
4. Open test cocks 2 and 3.
5. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
6. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.

FIGURE 41.



7. Record the differential gauge pressure reading. It should be a minimum of 1 psid.

8. Disconnect the hoses.

#### Step 2 Checking check valve number 2.

1. Connect the high hose to test cock number 3.
2. Connect the low hose to test cock number 4.
3. Open test cocks number 3 and 4.
4. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
5. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.
6. Record the differential gauge pressure reading. It should be a minimum of 1 psid.
7. Disconnect the hoses.

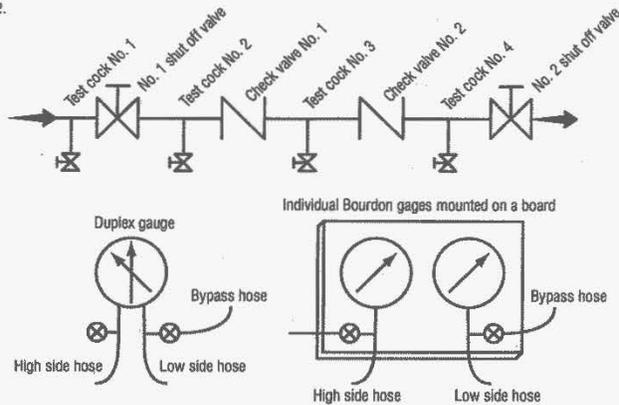
To check tightness of number 2 shut-off valve, both the check valves must be tight and holding a minimum of 1 psid. Also, little or no fluctuation of inlet supply pressure can be tolerated.

The testing is performed as follows:

1. Connect the high hose to number 2 test cock.
2. Connect the low hose to number 3 test cock.
3. Connect the bypass hose to number 4 test cock.
4. Open test cocks numbers 2, 3, and 4.
5. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
6. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.

7. The differential gauge pressure should read a minimum of 1 psid.
8. Open the high side control needle valve and the bypass hose control needle valve on the test kit. (This supplies high pressure water downstream of check valve number 2).
9. Close test cock number 2. (This stops the supply of any high pressure water downstream of number 2 shut-off valve). If the differential pressure gauge holds steady, the number 2 shut-off valve is recorded as being tight. If the differential pressure gauge drops to zero, the number 2 shut-off valve is recorded as leaking.

FIGURE 42.



With a leaking number 2 shut-off valve, the device is, in most cases, in a flow condition, and the previous test readings taken are invalid. Unless a non-flow condition can be achieved, either through the operation of an additional shut-off downstream, or the use of a temporary compensating bypass hose, accurate test results will not be achieved.

This completes the standard field test for a double check valve assembly. Prior to removal of the test equipment, the tester should insure that he opens number 2 shut-off valve thereby reestablishing flow. All test data should be recorded on appropriate forms and the test kit drained of water.

#### Method 2

Utilizing "Duplex Gauge" or individual bourdon gauges, requires closing number 1 shut-off. (Figure 42)

##### Step 1 checking check valve number 1

1. Connect the high hose to test cock number 2.
2. Connect the low hose to test cock number 3.
3. Open test cocks number 2 and number 3.
4. Close number 2 shut-off valve; then close number 1 shut-off valve.
5. By means of the high side needle valve, lower the pressure at test cock number 2 about 2 psi below the pressure at test cock number 3. If this small difference can be maintained, then check valve number 1 is reported as "tight". Proceed to Step number 2. If the small difference cannot be maintained, proceed to Step number 3.

##### Step 2 checking check valve number 2.

Proceed exactly the same test procedure as in Step number 1, except that the high hose is connected to test cock number 3 and the low hose connected to test cock number 4.

##### Step 3

1. Open shut-off valve number 1 to repressurize the assembly.
2. Loosely attach the bypass hose to test cock number 1, and bleed from the gauge through the bypass hose by opening the low side needle valve to eliminate trapped air. Close low side needle valve. Tighten bypass hose. Open test cock number 1.
3. Close number 1 shut-off valve.

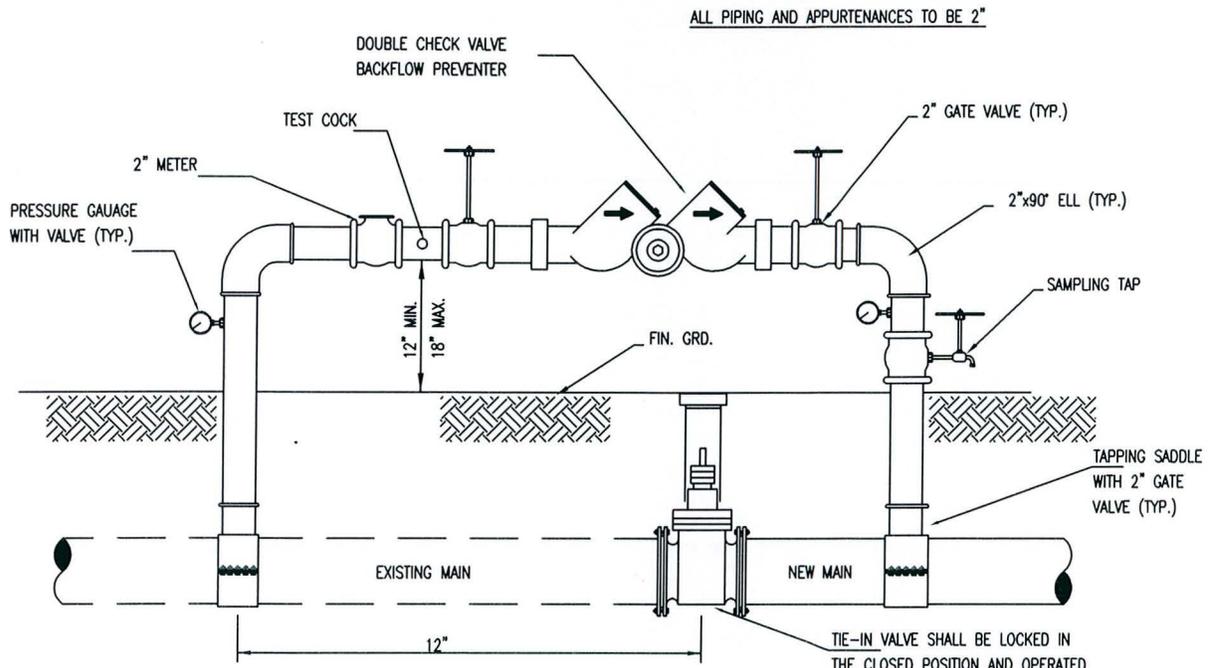
4. By loosening the low side hose at test cock number 3, lower the pressure in the assembly about 10 psi below normal line conditions.
5. Simultaneously open both needle valves. If the check valve is holding tight the high pressure gauge will begin to drop while the low pressure gauge will increase. Close needle valves. If the gauge shows that a small (no more than 5 psi) backpressure is created and held, then the check valve is reported as tight. If the check valve leaks, a pressure differential is not maintained as both gauges tend to equalize or move back towards each other, then the check valve is reported as leaking. With both needle valves open enough to keep the needles on the gauge stationary, the amount of leakage is visible as the discharge from the upstream needle valve.

# **CHAPER FIVE**

**DRAWINGS & DETAILS**

**CITY OF EUSTIS**

**ENGINEERING DEPARTMENTS**



USE AT POINT(S) OF FILLING. ALL OTHER LOCATIONS PROPOSED FOR CONNECTION TO EXISTING MAINS MUST REMAIN ISOLATED UNTIL F.D.E.P. LETTER IS OBTAINED.

TIE-IN VALVE SHALL BE LOCKED IN THE CLOSED POSITION AND OPERATED BY CITY PERSONNEL ONLY. IF NO VALVE IS PROVIDED, MAINTAIN PHYSICAL SEPARATION UNTIL F.D.E.P. LETTER OR CLEARANCE IS RECEIVED.

1. A TEMPORARY JUMPER CONNECTION IS REQUIRED AT ALL CONNECTIONS BETWEEN EXISTING ACTIVE WATER MAINS AND PROPOSED NEW WATER MAIN IMPROVEMENTS.
2. THIS DETAIL IS TO BE USED FOR FILLING ANY NEW WATER MAIN OF ANY SIZE FOR EXISTING ACTIVE WATER MAINS AND FOR FLUSHING OF NEW MAINS UP TO 8 INCHES IN DIAMETER (2.5 FPS MINIMUM VELOCITY), AND FOR PULLING BACTERIOLOGICAL SAMPLES FROM ANY NEW WATER MAIN OF ANY SIZE. THE JUMPER CONNECTION SHALL BE MAINTAINED UNTIL AFTER FILLING, FLUSHING, TESTING AND DISINFECTION OF THE NEW MAIN HAS BEEN SUCCESSFULLY COMPLETED AND CLEARANCE FOR USE FROM FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) HAS BEEN RECEIVED. THIS JUMPER CONNECTION SHALL ALSO BE USED TO MAINTAIN A MINIMUM PRESSURE OF 20 PSI IN THE NEW MAINS ALL THE TIME AFTER DISINFECTION AND UNTIL THE FDEP CLEARANCE LETTER IS OBTAINED. ADEQUATE THRUST BLOCKING AND/OR RESTRAINTS SHALL BE PROVIDED TEMPORARILY, AS REQUIRED. PIPE AND FITTINGS USED FOR CONNECTING THE NEW PIPE TO THE EXISTING PIPE SHALL BE DISINFECTED PRIOR TO INSTALLATION IN ACCORDANCE WITH AWWA C651, LATEST EDITION. THE TAPPING SLEEVE AND THE EXTERIOR OF THE MAIN TO BE TAPPED SHALL BE DISINFECTED BY SPRAYING OR SWABBING PER SECTION II OF AWWA C651 - LATEST.
3. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION DEMONSTRATING THAT THE DOUBLE CHECK BACKFLOW PREVENTION DEVICE HAS BEEN TESTED AND IS IN GOOD WORKING ORDER AT THE TIME OF INSTALLATION. THE TEST SHALL BE PERFORMED BY A QUALIFIED BACKFLOW PREVENTION TECHNICIAN.
4. EXCEPT AS REQUIRED TO FLUSH LINES OF GREATER THAN 8 INCHES IN DIAMETER, THE TIE-IN VALVE SHALL REMAIN CLOSED AND SHALL BE LOCKED IN THE CLOSED POSITION BY CITY PERSONNEL. THE TIE-IN VALVE SHALL REMAIN LOCKED CLOSED UNTIL THE NEW SYSTEM HAS BEEN CLEARED FOR USE BY THE FDEP.
5. UPON RECEIPT OF CLEARANCE FOR USE FROM FDEP, THE CONTRACTOR SHALL REMOVE THE TEMPORARY JUMPER CONNECTION. THE GATE VALVES ARE TO BE CLOSED AND PLUGGED WITH 2 INCH BRASS PLUGS.
6. ALL INSTALLATION AND MAINTENANCE OF THE TEMPORARY JUMPER CONNECTION AND ASSOCIATED BACKFLOW PREVENTION DEVICE, FITTINGS, VALVE, ETC., SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. WATER FOR TESTING AND DISINFECTION OF THE NEW WATER MAIN SHALL BE FURNISHED BY THE CITY. WATER FOR MAINTENANCE OR OTHER USES SHALL BE AT THE CONTRACTOR'S EXPENSE.
8. METER TO BE POSITIVE DISPLACEMENT TYPE CONFORMING TO THE REQUIREMENTS OF AWWA C-700 - LATEST. METER REGISTER SHALL READ IN GALLONS. METER MUST HAVE A VALID DATE OF CALIBRATION.

## JUMPER DETAIL



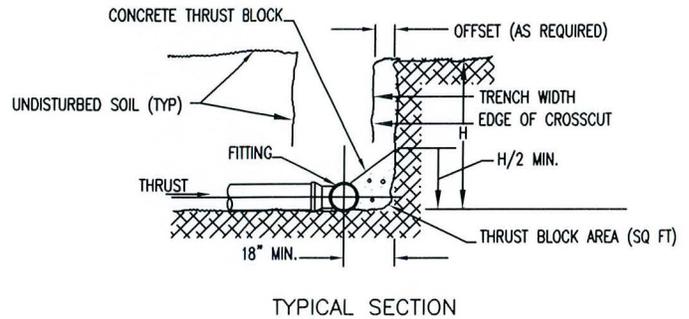
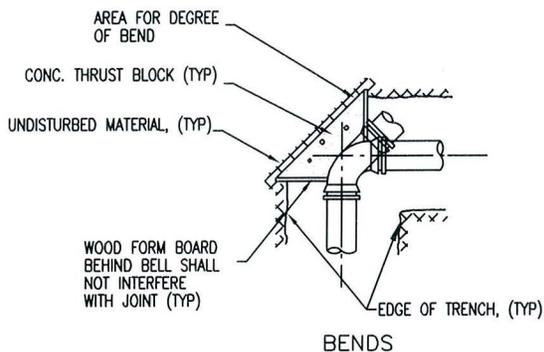
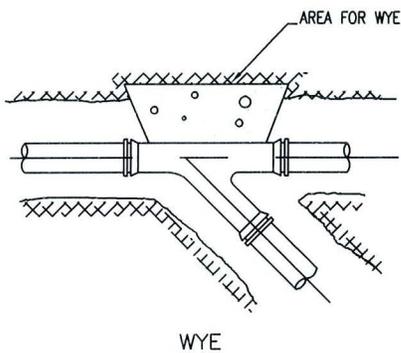
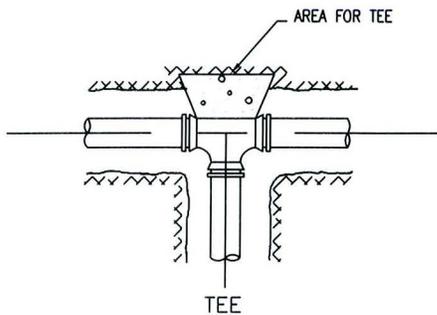
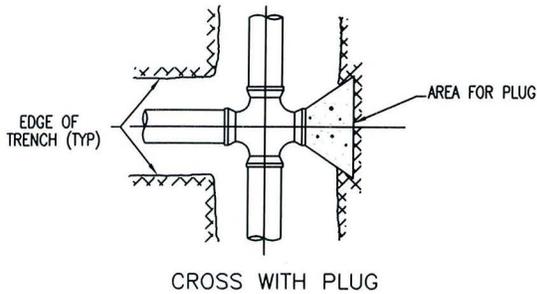
CITY OF EUSTIS  
ENGINEERING DEPT.  
P.O. DRAWER 68  
10 N. GROVE ST.  
EUSTIS, FL 32727-0068  
352-483-5480

JUMPER DETAIL

JOB NAME

DESIGN BY:	
DRAWN BY:	MNB
CHECKED BY:	RAG
HORIZ. SCALE:	N.T.S.
VERT. SCALE:	
DATE:	NOV. 10, 2016

SHEET OF



SCHEDULE FOR THRUST BLOCK AREAS						
PIPE SIZES (INCHES)	90° BEND (SQ. FT.)	45° BEND (SQ. FT.)	22-1/2° BEND (SQ. FT.)	11-1/4° BEND (SQ. FT.)	TEE & PLUG (SQ. FT.)	DESIGN PRESS (PSI)
4	2.0	1.0	0.5	0.3	1.4	150
6	4.0	2.2	1.1	0.6	2.9	150
8	7.0	3.9	1.9	0.9	5.0	150
10	11.4	6.2	3.2	1.6	8.1	150
12	16.3	8.8	4.5	2.3	11.5	150
NOTE: THRUST BLOCK AREAS COMPUTED ON BASIS OF 2,000 LBS. PER SQ. FT. SOIL RESISTANCE BEARING						

**THRUST BLOCK NOTES:**

1. THRUST BLOCK BEARING AREAS SHALL BE POURED AGAINST UNDISTURBED MATERIAL. WHERE TRENCH WALL HAS BEEN DISTURBED, EXCAVATE ALL LOOSE MATERIAL AND EXTEND TO UNDISTURBED MATERIAL.
2. EXTEND THRUST BLOCK FULL LENGTH OF FITTINGS. PUT BOARD IN FRONT OF PLUG BEFORE POURING CONCRETE. JOINTS SHALL NOT BE COVERED BY THRUST BLOCK.
3. ROUGH BLOCKING FORMS SHALL BE USED ALONG SIDES OF THRUST BLOCKS.
4. THRUST BLOCKS SHALL BE USED IN COMBINATION, AS REQUIRED, TO SUIT THE SPECIFIC FITTING ARRANGEMENT.
5. ALTERNATE DESIGNED RESTRAINING SYSTEMS SHALL BE PROVIDED WHERE STANDARD THRUST BLOCKING IS NOT SUITABLE.
6. ALL WOOD BLOCKING SHALL BE PRESSURE TREATED WITH PRESERVATIVE.

**THRUST BLOCKS**



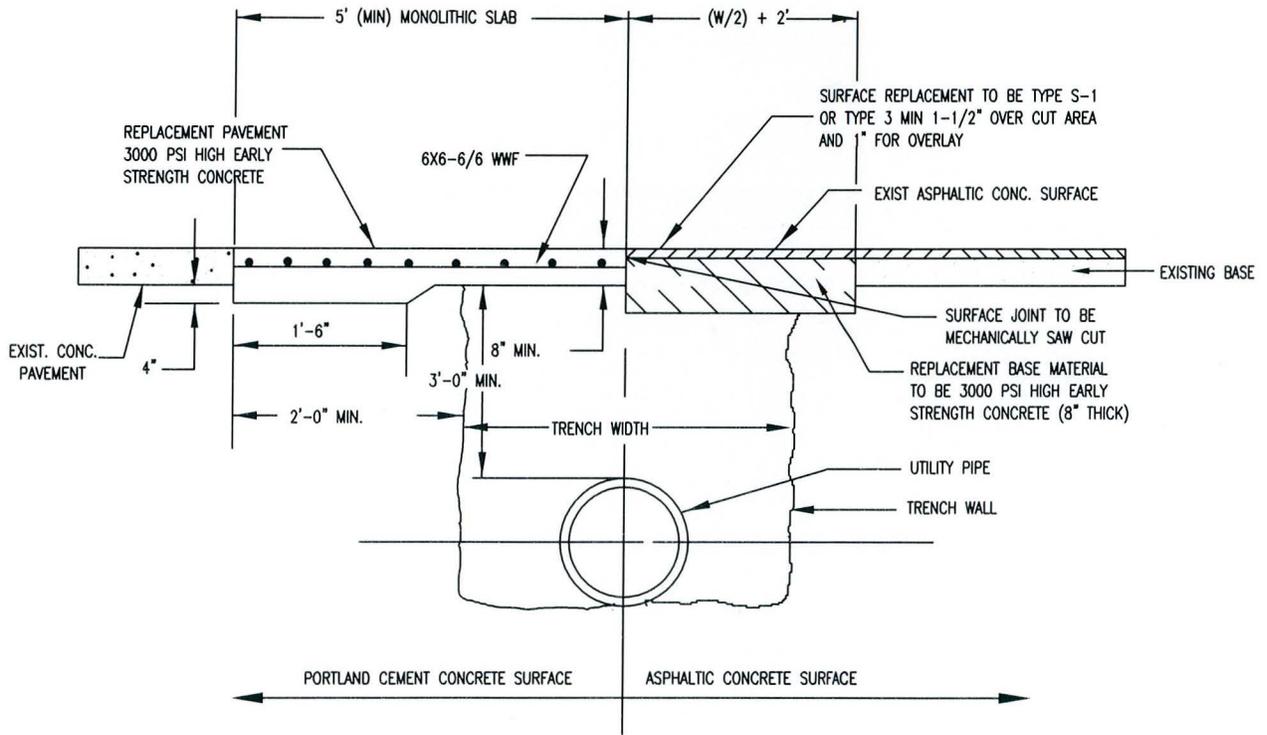
CITY OF EUSTIS  
ENGINEERING DEPT.  
P.O. DRAWER 68  
10 N. GROVE ST.  
EUSTIS, FL 32727-0068  
352-483-5480

THRUST BLOCKS

JOB NAME

DESIGN BY:  
DRAWN BY: MNB  
CHECKED BY: RAG  
HORIZ. SCALE: N.T.S.  
VERT. SCALE:  
DATE: NOV. 10, 2016

SHEET OF



**STANDARD ROADWAY  
OPEN CUT DETAIL**



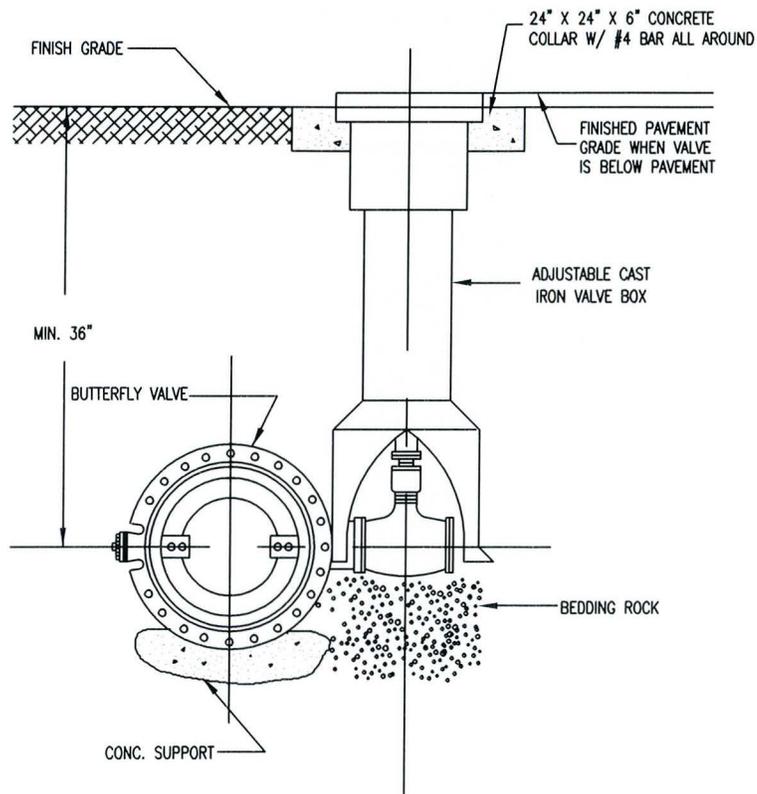
CITY OF EUSTIS  
ENGINEERING DEPT.  
P.O. DRAWER 68  
10 N. GROVE ST.  
EUSTIS, FL 32727-0068  
352-483-5480

STANDARD ROADWAY  
OPEN CUT DETAIL

JOB NAME

DESIGN BY:	
DRAWN BY:	MNB
CHECKED BY:	RAG
HORIZ. SCALE:	N.T.S.
VERT. SCALE:	
DATE:	NOV. 10, 2016

SHEET OF



**BUTTERFLY VALVE & BOX DETAIL**



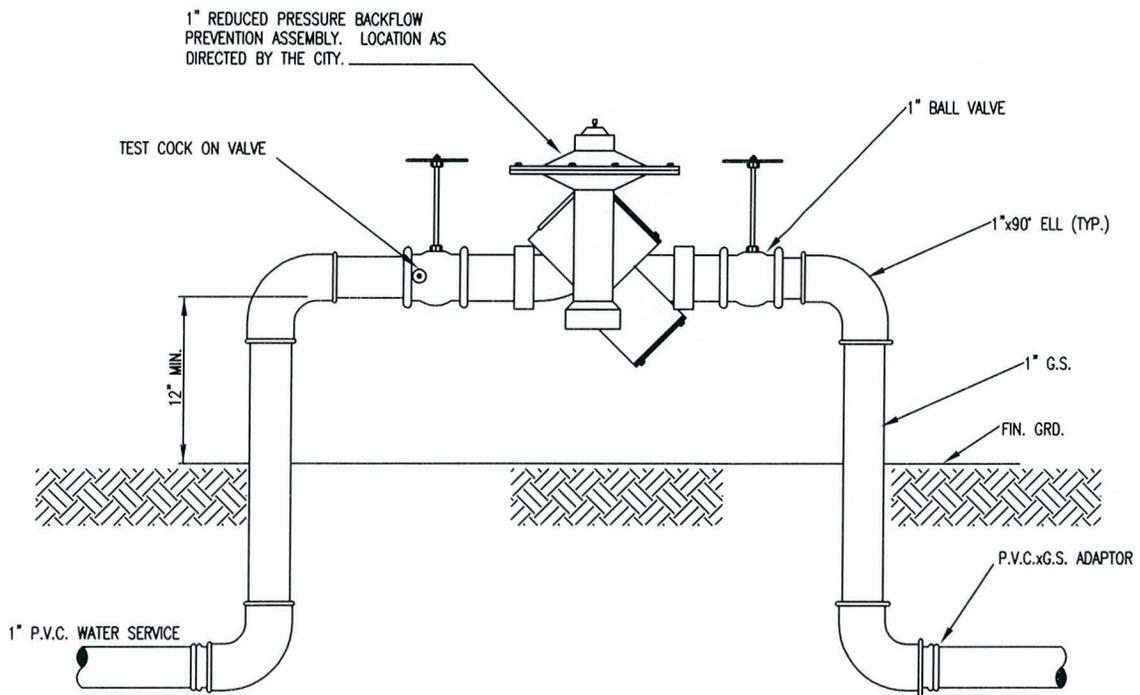
CITY OF EUSTIS  
 ENGINEERING DEPT.  
 P.O. DRAWER 68  
 10 N. GROVE ST.  
 EUSTIS, FL 32727-0068  
 352-483-5480

BUTTERFLY VALVE AND  
 BOX DETAIL

JOB NAME

DESIGN BY:  
 DRAWN BY: MNB  
 CHECKED BY: RAG  
 HORIZ. SCALE: N.T.S.  
 VERT. SCALE:  
 DATE: NOV. 10, 2016

SHEET OF



NOTE:

ALL PIPE AND FITTINGS SHALL BE THREADED SCHEDULE 40 GALVANIZED STEEL.

## BACKFLOW PREVENTION ASSEMBLY



CITY OF EUSTIS  
 ENGINEERING DEPT.  
 P.O. DRAWER 68  
 10 N. GROVE ST.  
 EUSTIS, FL 32727-0068  
 352-483-5480

BACKFLOW PREVENTION  
 ASSEMBLY

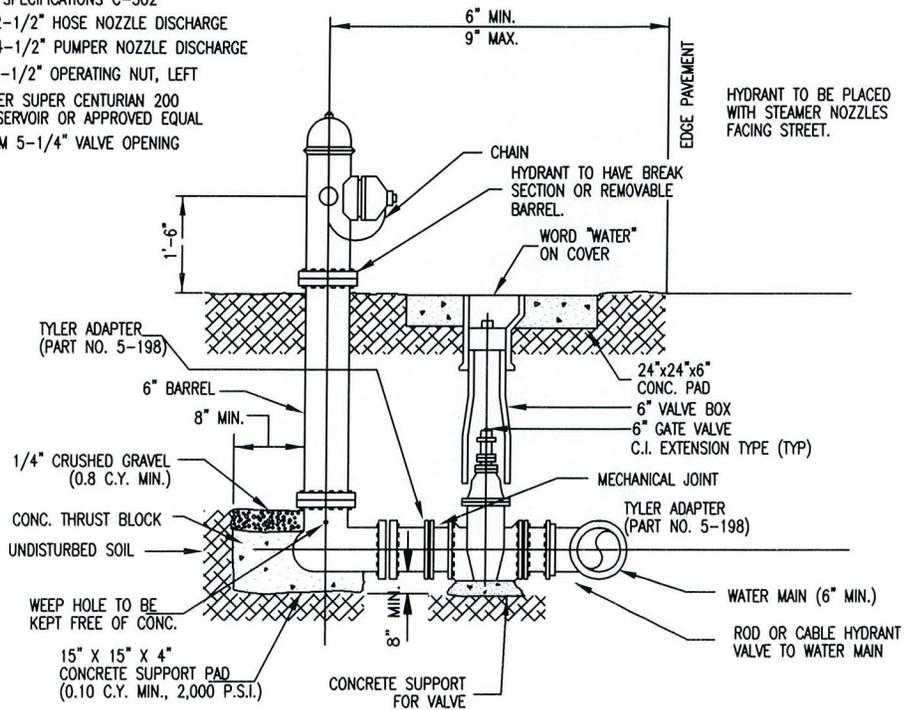
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**SPECIFICATIONS**

1. AWWA SPECIFICATIONS C-502
2. TWO 2-1/2" HOSE NOZZLE DISCHARGE
3. ONE 4-1/2" PUMPER NOZZLE DISCHARGE
4. ONE 1-1/2" OPERATING NUT, LEFT
5. MEULLER SUPER CENTURIAN 200 OIL RESERVOIR OR APPROVED EQUAL
6. MINIMUM 5-1/4" VALVE OPENING



HYDRANT TO BE PLACED WITH STEAMER NOZZLES FACING STREET.

1. MINIMUM OF SIX (6) FEET, MAXIMUM OF NINE (9) FEET FROM EDGE OF PAVEMENT.
2. COLOR TO BE RED
3. BLUE REFLECTIVE HYDRANT MARKERS INSTALLED PER CITY OF EUSTIS FIRE DEPARTMENT

**FIRE HYDRANT W/ VALVE**  
(STANDARD FIRE HYDRANT ASSEMBLY)



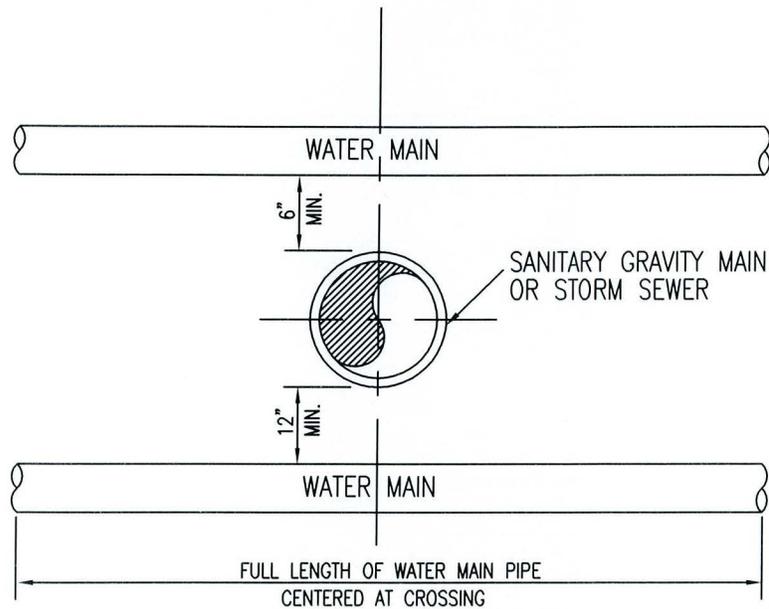
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Fire Hydrant Assembly

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NOTES:

1. NEW OR RELOCATED, UNDERGROUND WATER MAINS CROSSING ANY EXISTING OR PROPOSED GRAVITY- OR VACUUM-TYPE SANITARY SEWER OR STORM SEWER SHALL BE LAID SO THE OUTSIDE OF THE WATER MAIN IS AT LEAST 6 INCHES, AND PREFERABLY 12 INCHES, ABOVE OR AT LEAST 12 INCHES BELOW THE OUTSIDE OF THE OTHER PIPELINE. HOWEVER, IT IS PREFERABLE TO LAY THE WATER MAIN ABOVE THE OTHER PIPELINE.
2. NEW OR RELOCATED, UNDERGROUND WATER MAINS CROSSING ANY EXISTING OR PROPOSED PRESSURE-TYPE SANITARY SEWER, WASTEWATER OR STORMWATER FORCE MAIN, OR PIPELINE CONVEYING RECLAIMED WATER SHALL BE LAID SO THE OUTSIDE OF THE WATER MAIN IS AT LEAST 12 INCHES ABOVE OR BELOW THE OUTSIDE OF THE OTHER PIPELINE. HOWEVER, IT IS PREFERABLE TO LAY THE WATER MAIN ABOVE THE OTHER PIPELINE.
3. AT THE UTILITY CROSSINGS DESCRIBED ABOVE, ONE FULL LENGTH OF WATER MAIN PIPE SHALL BE CENTERED ABOVE OR BELOW THE OTHER PIPELINE SO THE WATER MAIN JOINTS WILL BE AS FAR AS POSSIBLE FROM THE OTHER PIPELINE. ALTERNATIVELY, AT SUCH CROSSINGS, THE PIPES SHALL BE ARRANGED SO THAT ALL WATER MAIN JOINTS ARE AT LEAST THREE FEET FROM ALL JOINTS IN VACUUM-TYPE SANITARY SEWERS, STORM SEWERS, STORMWATER FORCE MAINS, OR PIPELINES CONVEYING RECLAIMED WATER REGULATED UNDER PART III OF CHAPTER 62-610, F.A.C., AND AT LEAST SIX FEET FROM ALL JOINTS IN GRAVITY-OR PRESSURE-TYPE SANITARY SEWERS, WASTEWATER FORCE MAINS, OR PIPELINES CONVEYING RECLAIMED WATER NOT REGULATED UNDER PART III OF CHAPTER 62-610, F.A.C.

WATER MAIN CROSSING DETAIL



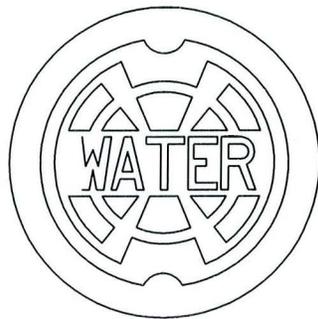
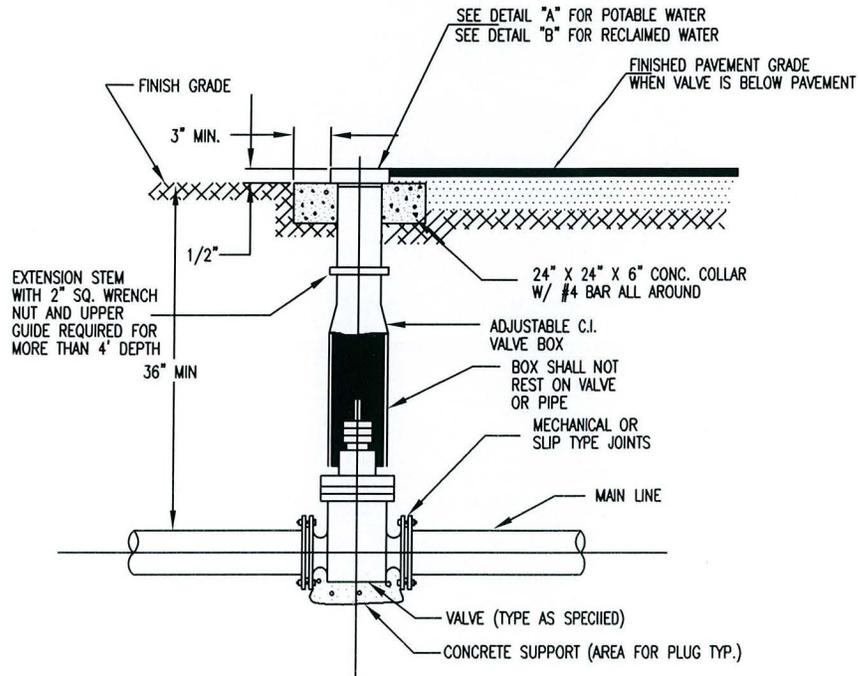
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Water Main Crossing

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DETAIL "A"



DETAIL "B"

**VALVE & VALVE BOX DETAIL**



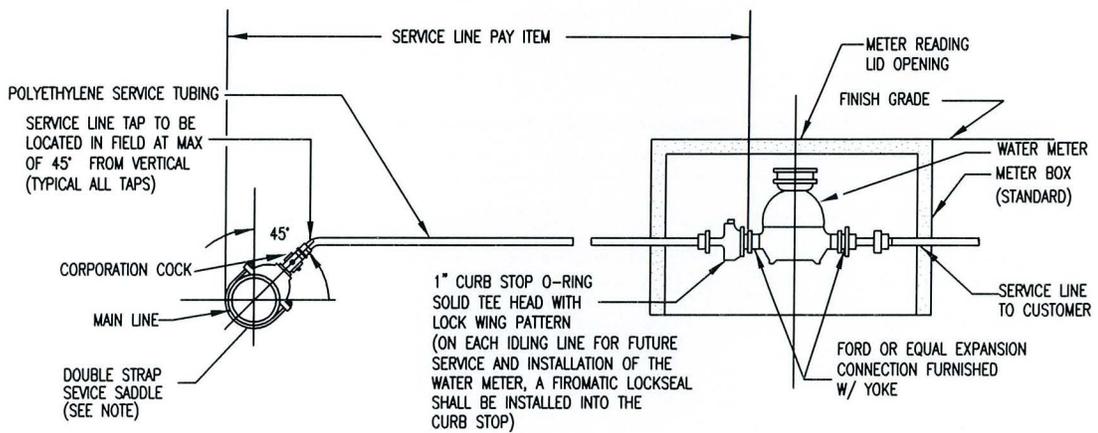
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VALVE & VALVE BOX

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**NOTE:** ALL MAIN LINE SERVICE CONNECTION TAPS (1" & 1 1/2" INDIVIDUAL OR BRANCHED) SHALL BE MADE WITH A DOUBLE STRAP SERVICE SADDLE.

## TYPICAL MAIN LINE, SERVICE LINE AND METER CONNECTION



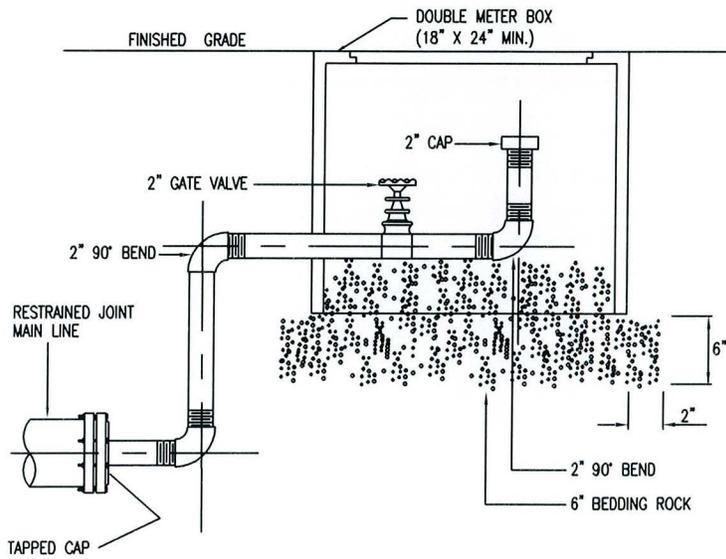
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SERVICE LINE  
CONNECTION

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NOTE:

1. ALL 2" PIPE AND FITTINGS SHALL BE SCHEDULE 40 GALVANIZED STEEL OR BRASS WITH THREADED (NPT) JOINTS.

## BLOWOFF VALVE



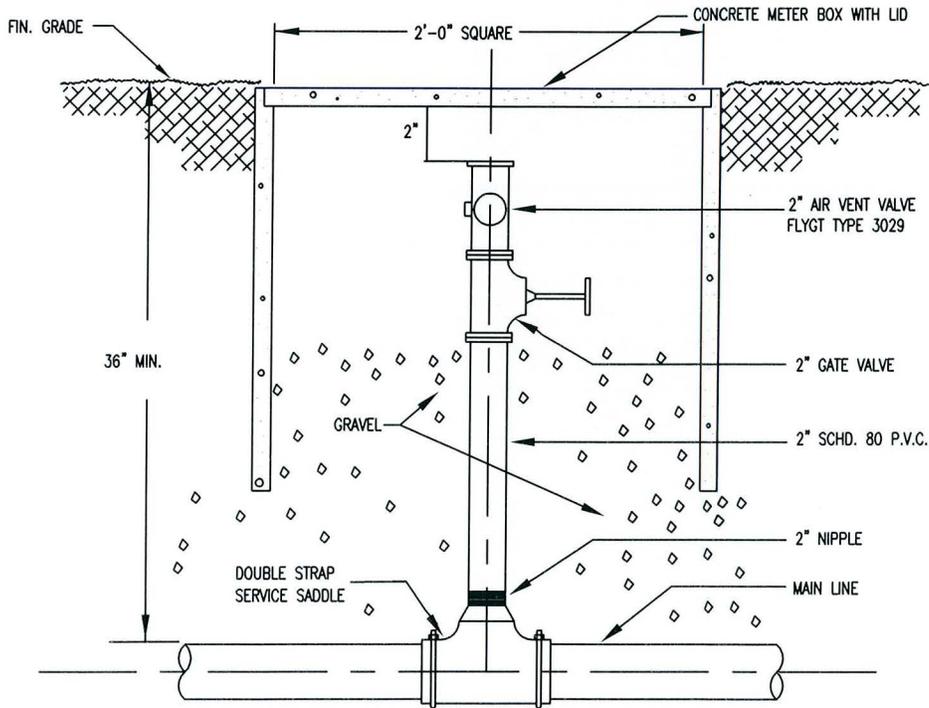
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BLOWOFF VALVE

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**AIR RELEASE VALVE DETAIL**



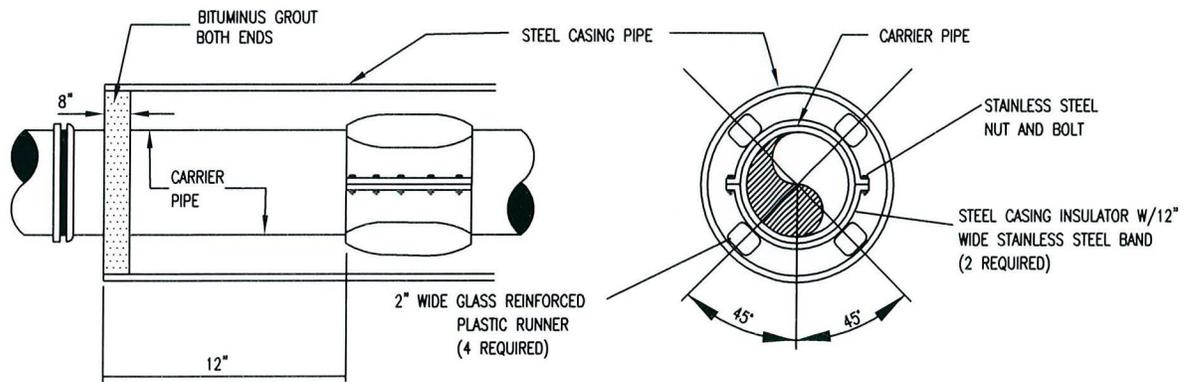
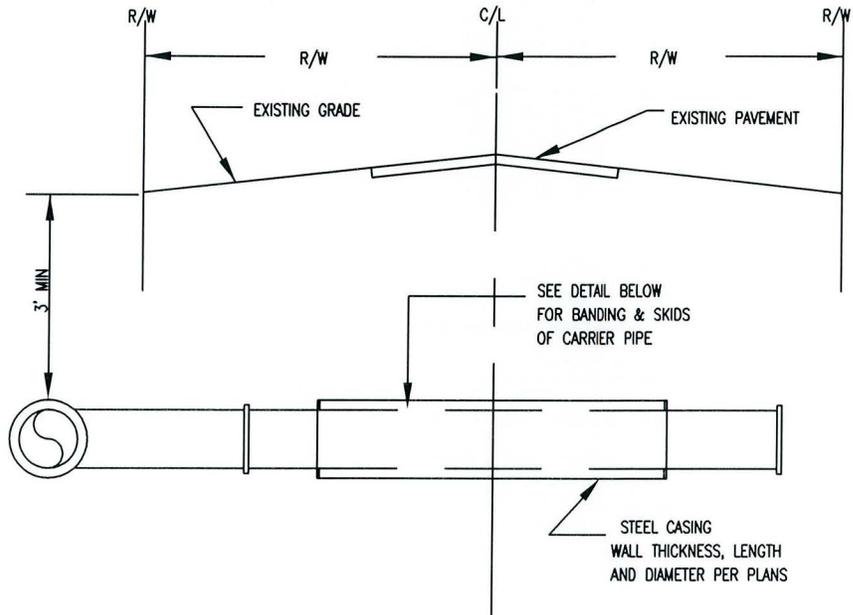
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AIR RELEASE VALVE

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**NOTES:**

1. A STEEL CASING INSULATOR (SKID) SHALL BE INSTALLED 12" FROM EACH END OF CASING.
2. THE MAXIMUM SPACING FOR THE STEEL CASING INSULATOR IS 12 FEET.
3. BOTH ENDS OF THE STEEL CASING PIPE SHALL BE SEALED WITH 8" OF BITUMASTIC GROUT OR OTHER SEALING MATERIAL.

**BORE AND JACK DETAIL**

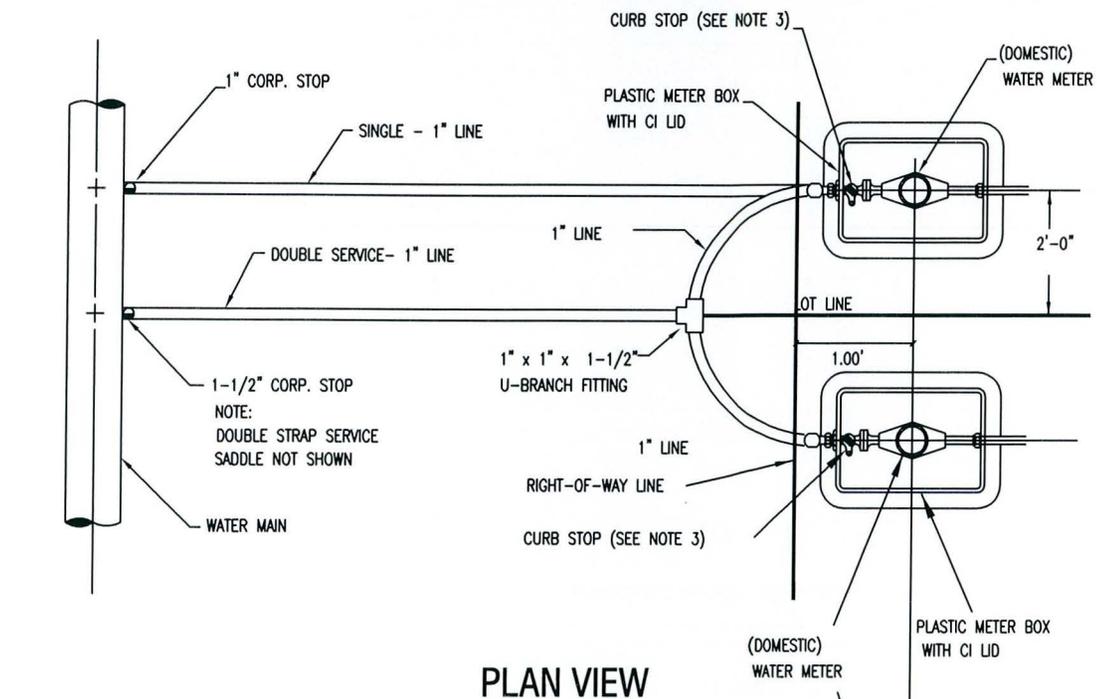


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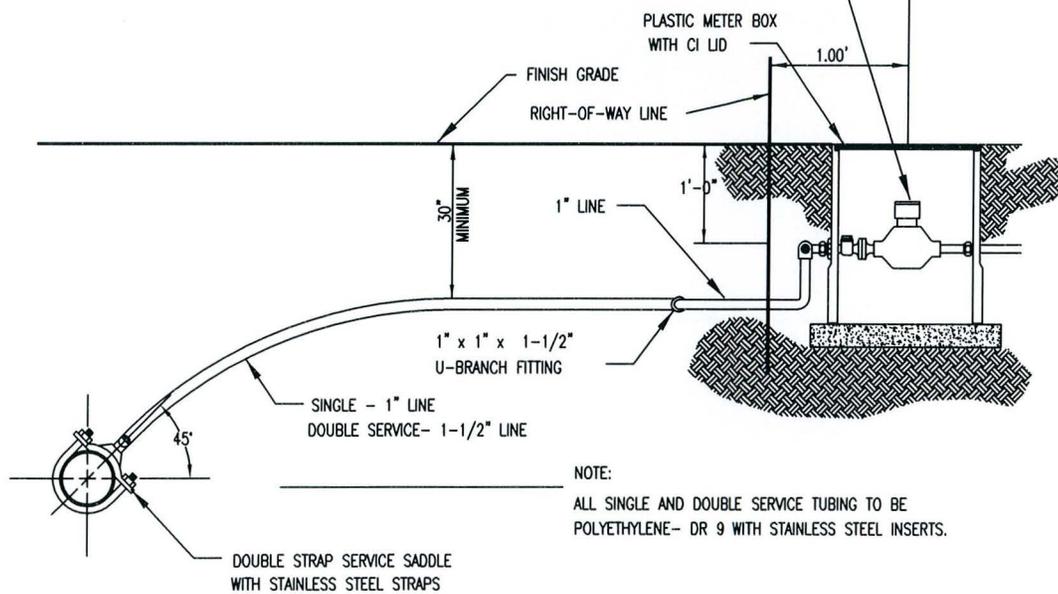
BORE & JACK

JOB NAME

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VERT. SCALE:		
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PLAN VIEW



SECTION

- NOTES:
1. ALL FITTINGS SHALL BE BRASS WITH COMPRESSION/PACK JOINT TYPE CONNECTIONS.
  2. NO SERVICE LINE SHALL TERMINATE UNDER A DRIVEWAY.
  3. EACH SERVICE SHALL TERMINATE AT A CURB STOP(S) WHICH SHALL BE BURIED APPROXIMATELY 3' BELOW FINAL GRADE & SHALL BE CLEARLY MARKED WITH A 2" x 2" x 18" STAKE WITH THE TOP PAINTED BLUE AND MARKED WITH THE NUMBER OF LOTS TO BE SERVED.
  4. METERS 2 INCHES AND SMALLER ARE TO BE INSTALLED BY FLORIDA WATER SERVICES' PERSONNEL.
  5. SERVICE TUBING SHALL BE BLUE POLYETHYLENE ENDOT ENDOPURE.

SERVICE CONNECTION DETAILS



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SERVICE LINE CONNECTION

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PIPE RESTRAINT FOR D.I. PIPE MINIMUM RESTRAINED LENGTH (FT) - EACH SIDE OF FITTING										
PIPE SIZE - INCHES										
FITTING TYPE	4	6	8	10	12	14	16	18	20	24
VERT. UP OR HORIZ										
11-1/4 BEND	2	3	4	4	5	6	6	7	8	9
22-1/2 BEND	4	6	7	9	10	12	13	14	16	18
45 BEND	8	12	15	18	21	24	27	30	32	37
90 BEND	20	29	37	44	52	59	65	72	78	90
VERTICAL DOWN										
11-1/4 BEND	4	6	8	9	11	12	14	15	17	19
22-1/2 BEND	8	12	15	19	22	25	28	31	34	39
45 BEND	17	25	32	39	45	52	58	64	70	82
90 BEND	42	60	77	94	109	125	140	155	169	197
BRANCH OF TEE	15	31	48	63	79	94	108	123	136	164
DEAD END	42	60	77	94	109	125	140	155	169	197
REDUCERS										
SIZE	6X4	8X4	8X6	10X6	10X8	12X6	12X8	12X10	14X6	14X8
RESTR. LENGTH	31	57	33	59	32	82	59	32	103	84
SIZE	16X6	16X8	16X12	18X8	18X12	18X16	20X12	20X16	24X12	24X16
RESTR. LENGTH	123	106	60	126	86	32	109	60	150	110

PIPE RESTRAINT FOR PVC PIPE (C-900/C-905 DR 18) MINIMUM RESTRAINED LENGTH (FT) - EACH SIDE OF FITTING										
PIPE SIZE - INCHES										
FITTING TYPE	4	6	8	10	12	14	16	18	20	24
VERT. UP OR HORIZ										
11-1/4 BEND	2	3	4	5	6	6	7	8	9	10
22-1/2 BEND	5	6	8	10	12	13	15	16	17	20
45 BEND	10	13	17	21	24	27	30	33	36	41
90 BEND	23	32	42	50	58	66	73	80	87	100
VERTICAL DOWN										
11-1/4 BEND	6	8	10	12	14	16	18	20	22	25
22-1/2 BEND	11	16	20	24	28	32	36	40	43	50
45 BEND	23	33	42	51	59	67	75	83	91	105
90 BEND	56	79	102	122	143	163	182	201	219	253
BRANCH OF TEE	20	41	63	83	103	129	141	159	177	210
DEAD END	56	79	102	122	143	163	182	201	219	253
REDUCERS										
SIZE	6X4	8X4	8X6	10X6	10X8	12X6	12X8	12X10	14X6	14X8
RESTR. LENGTH	41	74	43	76	41	106	77	42	133	108
SIZE	16X6	16X8	16X12	18X8	18X12	18X16	20X12	20X16	24X12	24X16
RESTR. LENGTH	159	137	79	163	111	41	141	78	194	142

## PIPE RESTRAINT LENGTHS



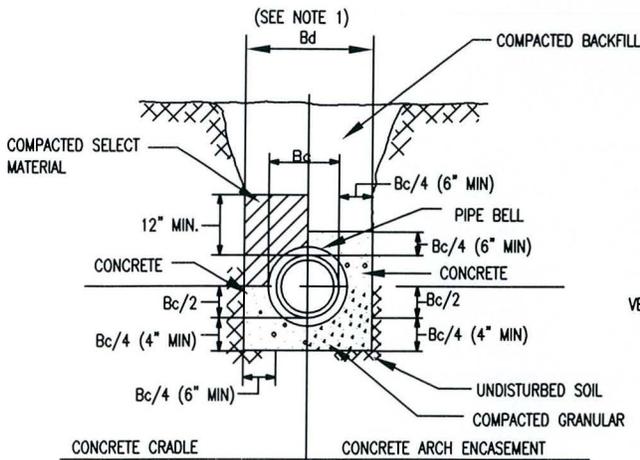
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PIPE RESTRAINT LINKS

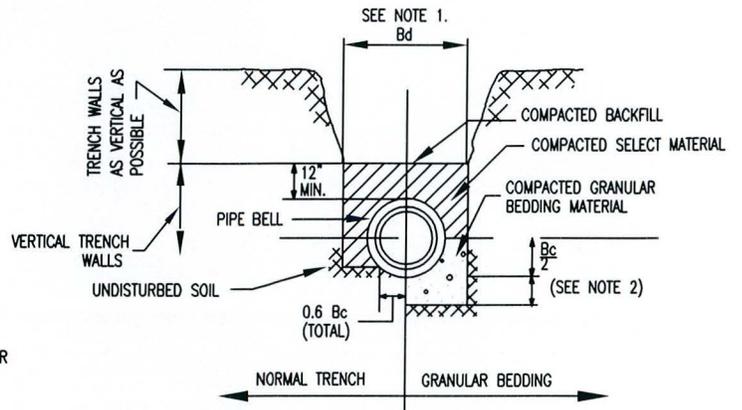
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**CLASS "A" BEDDING  
SPECIAL CONDITIONS**



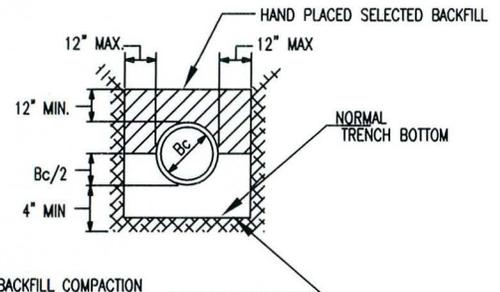
**CLASS "B" BEDDING  
NORMAL CONDITIONS**

**BEDDING & TRENCHING NOTES:**

1.  $B_c$  = PIPE O.D.  
 $B_d$  = TRENCH WIDTH AT TOP OF PIPE  
 MAX.  $B_d = B_c + 24"$   
 MIN.  $B_d = \text{MAX. DIM. OF BELL} + 8"$  (UNSHEETED TRENCH)  
 MAX. DIM. OF BELL + 12" (UNSHEETED TRENCH)
2. DEPTH FOR REMOVAL OF UNSUITABLE MATERIAL SHALL BE AS REQ'D TO REACH SUITABLE FOUNDATION; FOR NON-CUSHIONING MATERIAL, DEPTH SHALL BE 6" BELOW BOTTOM OF UTILITY.
3. SHEETING SHALL BE DRIVEN BELOW THE UTILITY INVERT IF REQUIRED FOR LATERAL SUPPORT OR UNSUITABLE MATERIAL REMOVAL. WHERE DRIVEN BELOW PIPE INVERT, SHEETING SHALL BE CUT OFF A MIN. OF 12" ABOVE TOP OF PIPE, OR HIGHER AS AUTHORIZED BY THE ENGINEER, AND LEFT IN PLACE. IN NO CASE SHALL SHEETING LEFT IN PLACE EXTEND HIGHER THAN 30" BELOW SURFACE GRADE UNLESS SPECIFICALLY APPROVED. BRACING SHALL BE PROVIDED AS REQUIRED.

**NOTE:**

NORMALLY CLEAN BACKFILL SHALL BE USED AS A 4" MIN. BEDDING FOR PIPE HOWEVER, WHERE UNSTABLE TRENCH BOTTOM CONDITIONS ARE ENCOUNTERED, AS DETERMINED BY THE INSPECTING ENGINEER A SUFFICIENT DEPTH OF THE UNSTABLE SOIL SHALL BE REMOVED AND REPLACED WITH 1/4" - 3/4" CRUSHED STONE, GRAVEL (U.S.C.S. SOIL CLASSIFICATION - CLASS 1), OR CRUSHED SHELL TO THE SPRING LINE OF THE PIPE TO STABILIZE THE PIPE BEDDING. WHEN DRY UNSUITABLE MATERIAL (I.E. HARDPAN) IS ENCOUNTERED AT THE TRENCH BOTTOM, GRADED SANDS MAY BE USED FOR PIPE BEDDING.



BEDDING & BACKFILL COMPACTION DENSITY TO 95% MODIFIED PROCTOR A.A.S.H.O. T-180 (A.S.T.M.D.-1557)

BEDDING AND BACKFILL PLACED IN LIFTS NOT EXCEEDING 6" IN THICKNESS

(FOR P.V.C. GRAVITY SEWER PIPE ALL BEDDING IN COMPLIANCE W/ A.S.T.M. D2321-74)

**STANDARD BEDDING**

**TRENCH BEDDING**



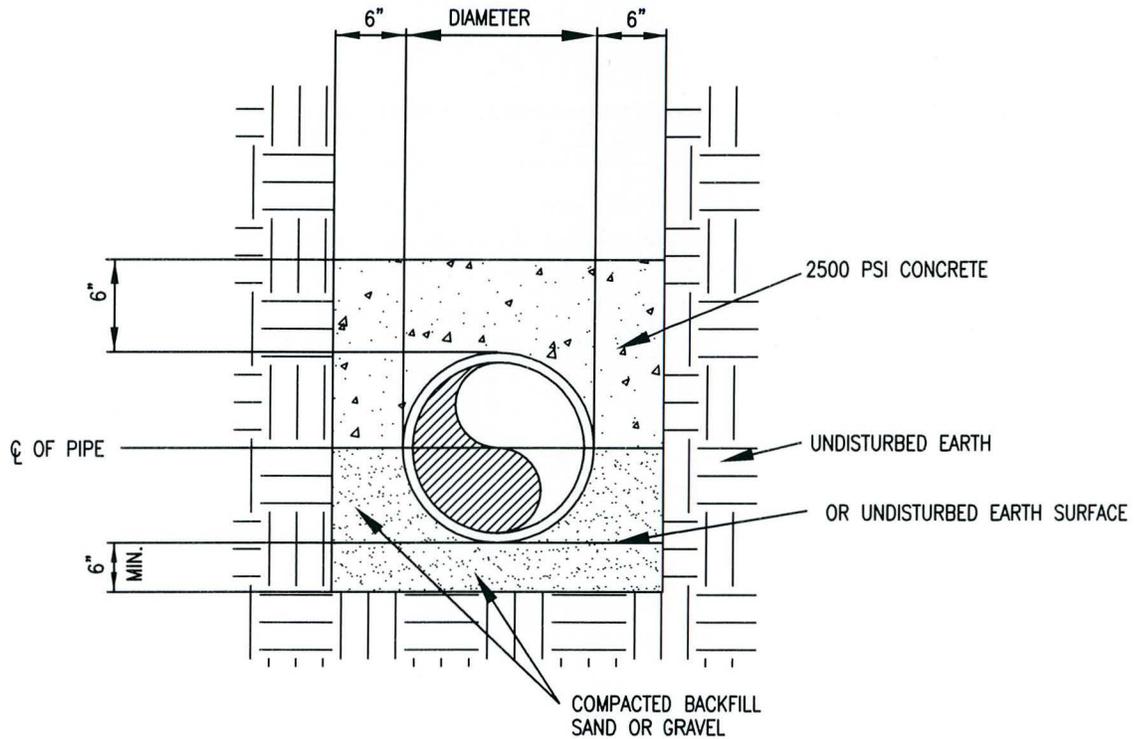
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TRENCH BEDDING

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**CONCRETE ARCH DETAIL**



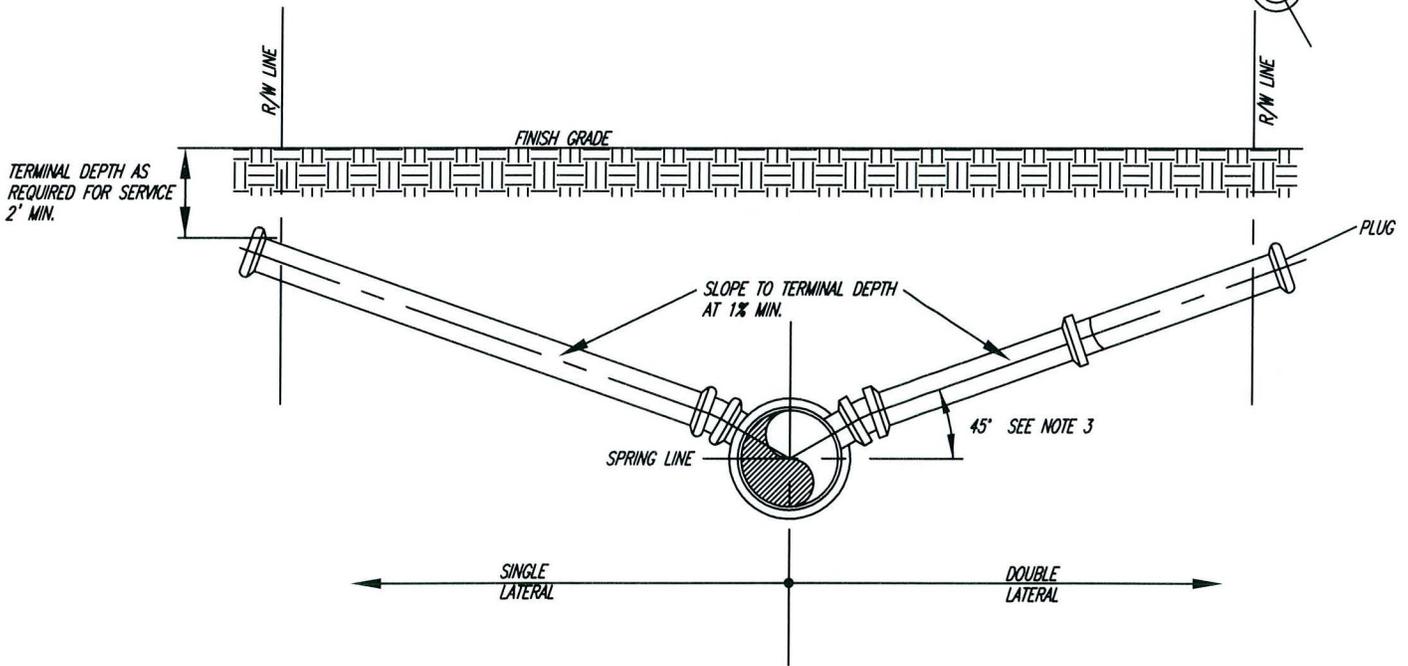
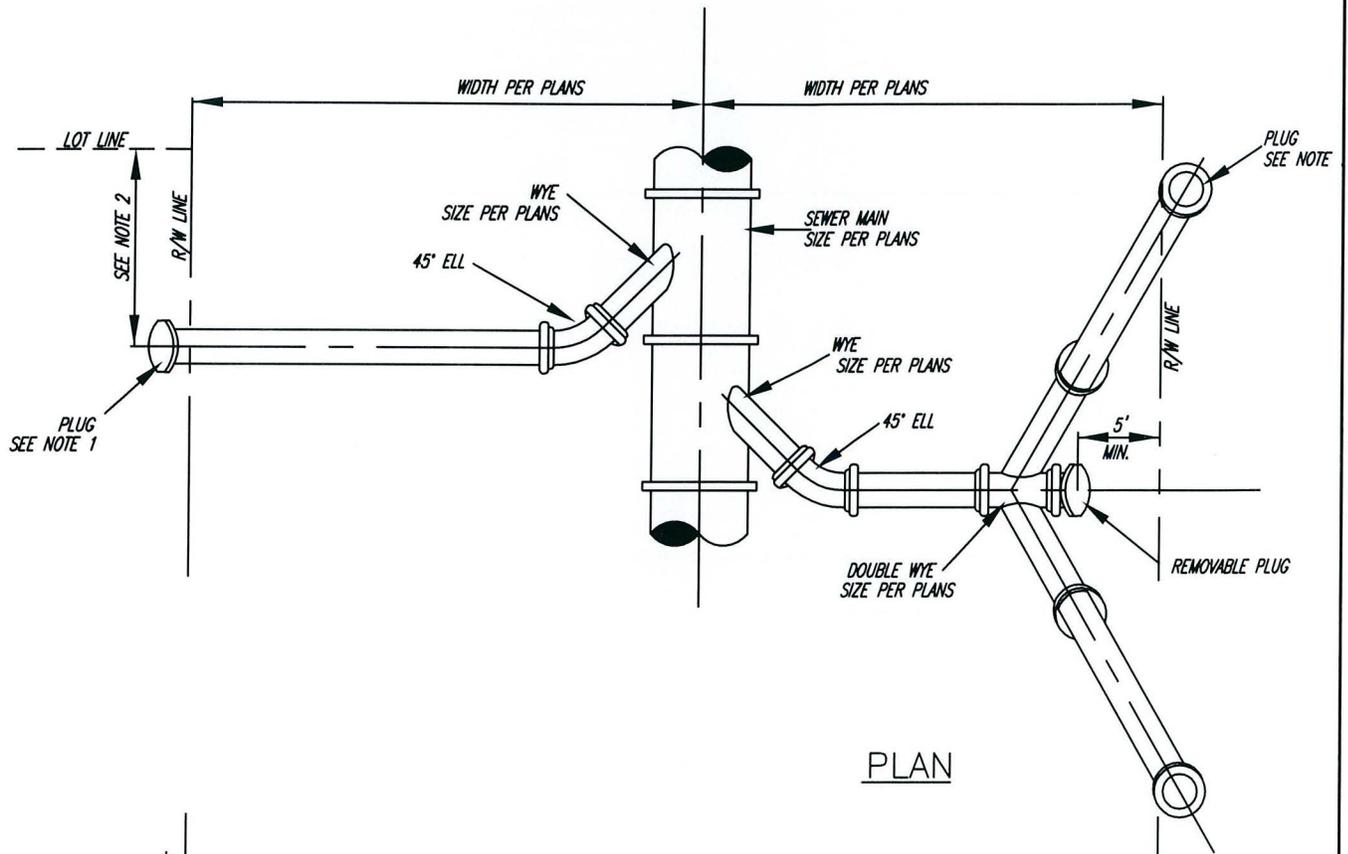
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CONCRETE ARCH DETAIL

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- NOTES:
1. PLUG SHALL BE INSTALLED BY THE BUILDER IN ACCORDANCE WITH STANDARD PLUMBING CODES.
  2. LOCATE SINGLE LATERAL AS CLOSE TO LOT LINE AS POSSIBLE, 25" MAXIMUM.
  3. INVERT OF SERVICE LATERAL SHALL NOT ENTER SEWER MAIN BELOW SPRING LINE.

**SEWER SERVICE LATERAL DETAIL**



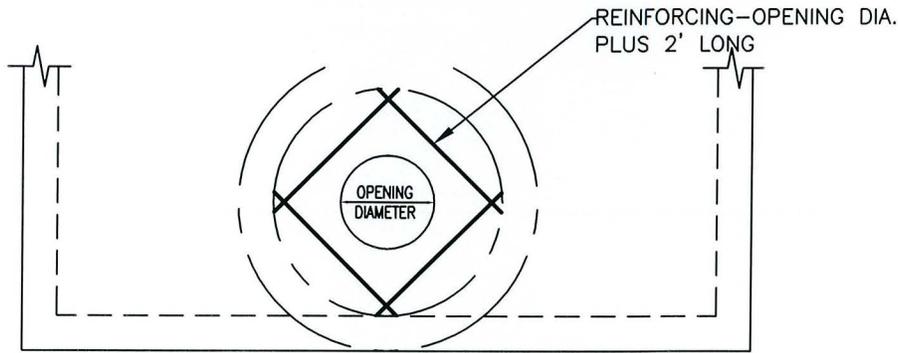
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SEWER LATERAL

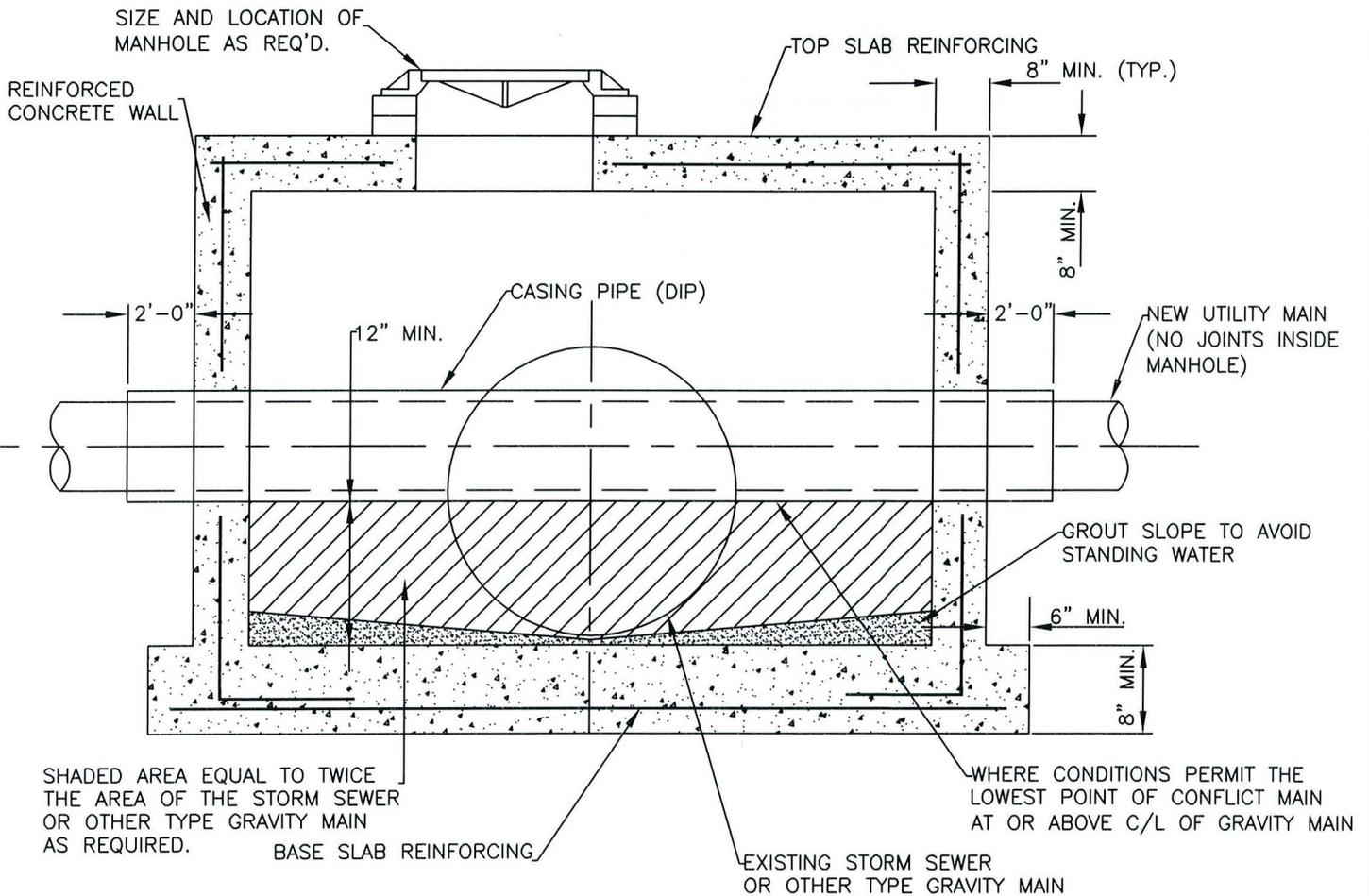
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PARTIAL PLAN



NOTES:

1. CONFLICT MANHOLES WILL BE ALLOWED WHERE DESIGN PROBLEMS AND ECONOMICS PROVE THEM TO BE THE ONLY VIABLE SOLUTION AND MUST BE APPROVED BY THE CITY OF EUSTIS AND ENGINEER OF RECORD.
2. CONFLICT MANHOLES WILL NOT BE ALLOWED FOR WATER MAINS CROSSING GRAVITY WASTEWATER SYSTEMS.

CONFLICT MANHOLE DETAIL



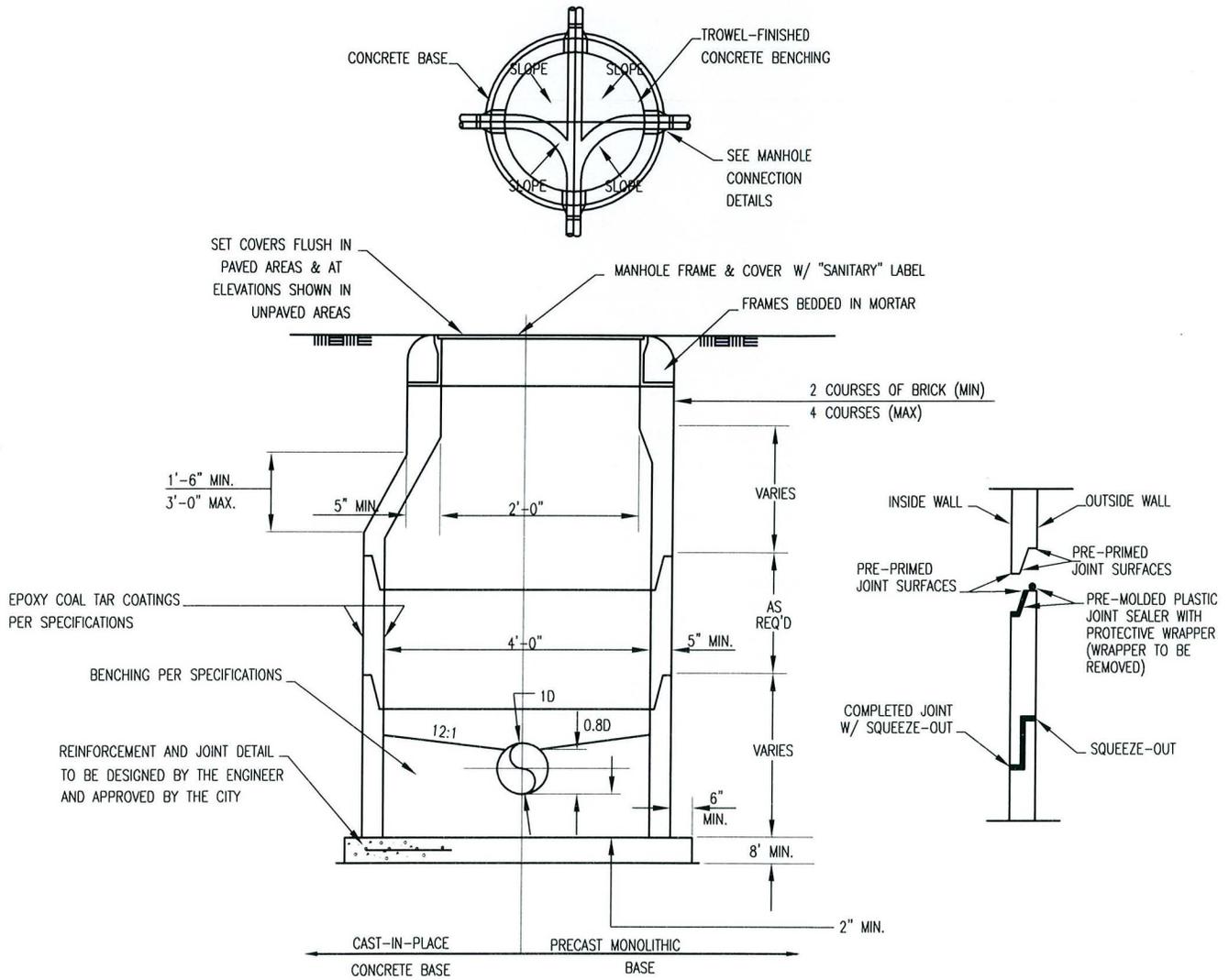
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CONFLICT MANHOLE

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NOTES:

1. DROP CONNECTIONS ARE REQUIRED WHENEVER INVERT OF INFLUENT, SEWER IS 24" OR MORE ABOVE THE INVERT OF THE MANHOLE. SEE MANHOLE CONNECTION DETAILS.
2. APPROVED CONCENTRIC CONE DESIGN MAY BE USED AS AN ALTERNATE.

**PRECAST CONCRETE MANHOLE**  
**PLAN & SECTION**



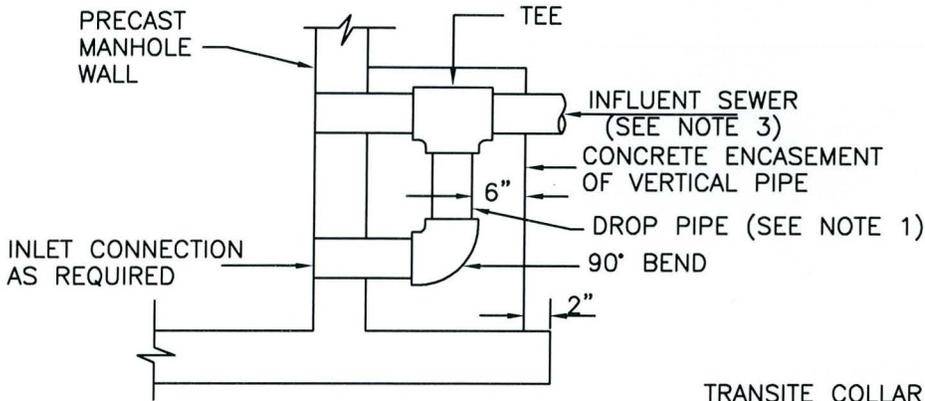
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PRECAST CONCRETE MANHOLE

JOB NAME

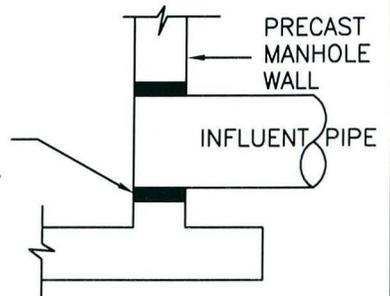
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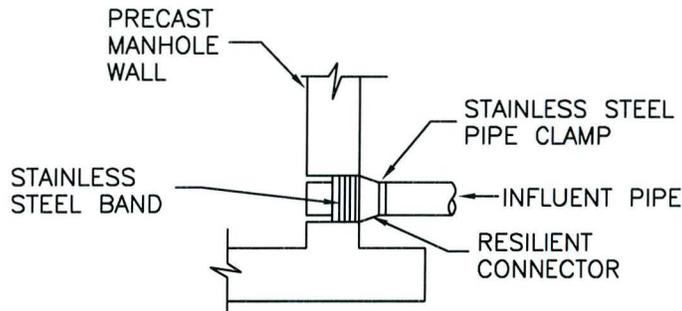


STANDARD DROP DETAIL

TRANSITE COLLAR ENCASED  
IN NON-SHRINK GROUT  
FLUSH WITH MANHOLE WALL  
(SEE NOTE 2)



SPECIAL DETAIL FOR 24" DIAMETER  
PIPE AND LARGER



STANDARD PRECAST MANHOLE  
PIPE CONNECTION

NOTES:

1. DROP PIPE AND FITTINGS SHALL BE OF EQUAL SIZE AND MATERIAL AS THE INFLUENT SEWER.
2. THE CITY MAY APPROVE ALTERNATE WATER TIGHT CONNECTION DETAILS FOR CONNECTION OF 24" DIAMETER PIPES AND LARGER.
3. AN OUTSIDE DROP CONNECTION SHALL BE REQUIRED FOR ALL INFLUENT WHICH HAVE AN INVERT 2'-0" OR MORE ABOVE THE MANHOLE INVERT.

**MANHOLE CONNECTION DETAILS**



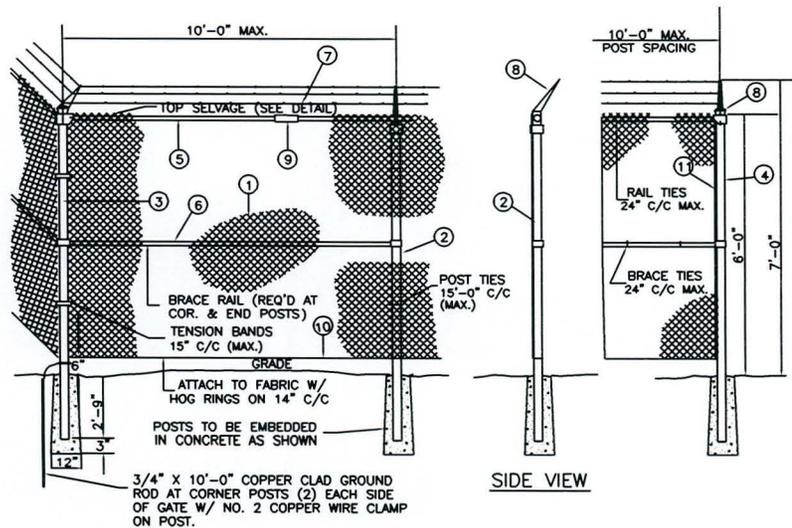
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MANHOLE CONNECTION DETAILS

JOB NAME

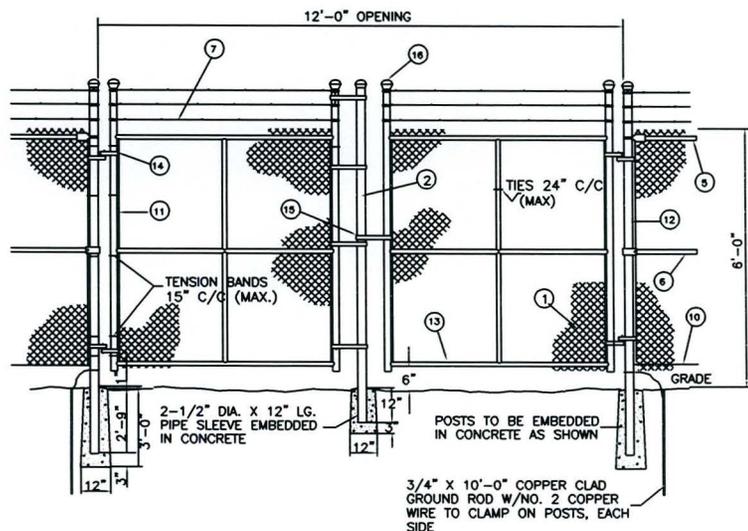
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SHEET OF



CHAIN LINK FENCE  
ELEVATION

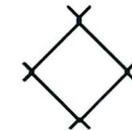
NO.	ITEM	MATERIAL
1	6'-0" HIGH CHAIN LINK FENCE, 9 GAUGE, 2" MESH	
2	LINE POSTS 2" O.D.	
3	CORNER POSTS 3" O.D.	
4	END POSTS 3" O.D.	
5	TOP RAIL 1-5/8" O.D.	
6	BRACE RAIL 1-5/8" O.D.	
7	BARBED WIRE, 3 STRAND, 9 GAUGE	
8	COMBINATION TOP & BARBED WIRE SUPPORT ARM	
9	TOP RAIL COUPLING, 6" LONG (MIN), 21'-0" C.C.	
10	TENSION WIRE, 7 GAUGE, S.C.	
11	STRETCHER BARS 3/16" X 3/4" MIN.	
12	GATE POSTS 3" O.D.	
13	GATE FRAME 2" O.D.	
14	GATE HINGE ASSEMBLY	
15	GATE LATCH ASSEMBLY	
16	POST ORNAMENTAL TOP	
17	CARRIAGE BOLT 3/8"x3" W/WASHERS & NUT	GALV.
NOTES: ALL MATERIALS TO BE VINYL GREEN COATED		



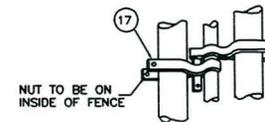
GATE ELEVATION



14 HINGE ASSEMBLY



DETAIL OF TWISTED SELVAGE



15 LATCH ASSEMBLY



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FENCE DETAIL

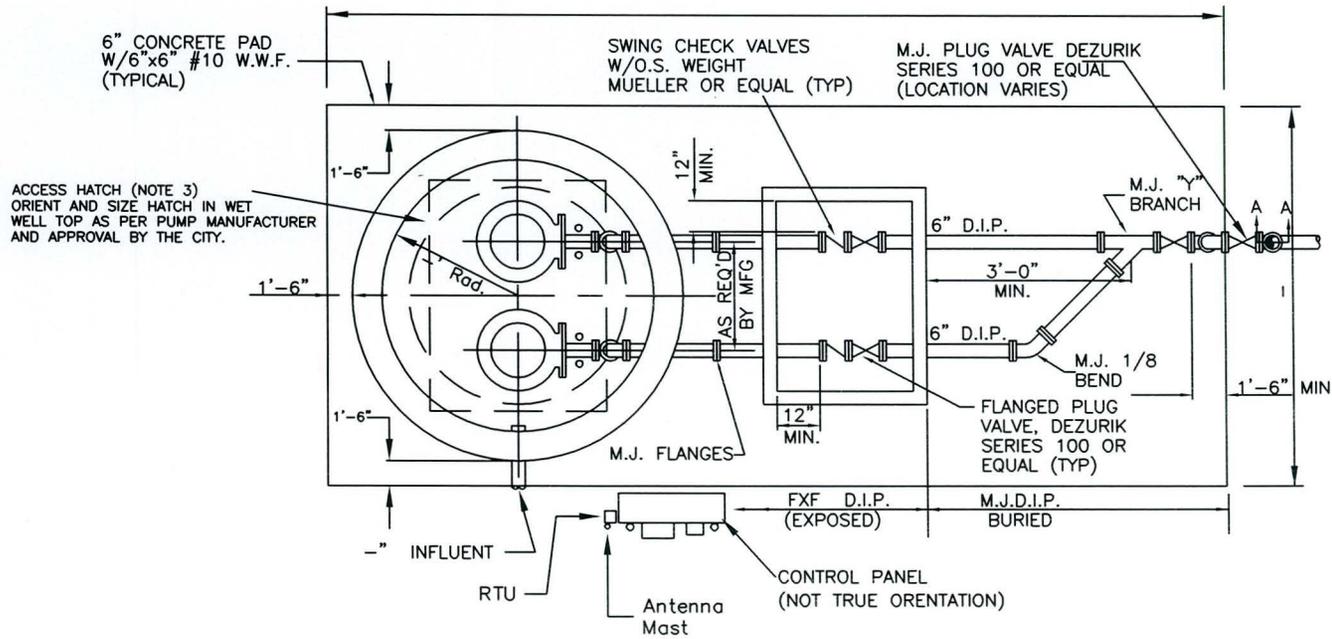
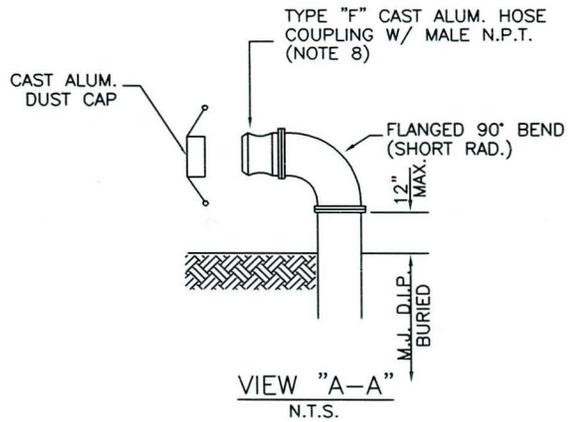
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LIFT STATION  
 PLAN VIEW

JOB NAME

REVISION #	DATE

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GENERAL NOTES

1. TWO SUBMERSIBLE PUMPS EACH RATED  $\odot$  - gpm, - ft. T.D.H., - HP. 1 pump shall have a PPMIXFLUSH mix flush valve. PUMPS TO BE MANUFACTURED BY "FLYGT" OR APPROVED EQUAL.
2. LIQUID LEVEL SENSORS TO BE "FLYGT" ENH-10 (4 EACH)
3. WET WELL ACCESS HATCH TO BE 300# CHECKERED ALUMINUM PLATE WITH PADLOCK STAPLE AND HASP, SWING HANDLE AND 316 STAINLESS STEEL FITTINGS AND ACCESSORIES AS MANUFACTURED BY "HALLIDAY" OR APPROVED EQUAL. HATCH FRAME TO BE INTEGRALLY CAST IN TOP. PROVIDE SIX (6) "MASTER" LOCKS KEYS ALIKE. CITY WILL PROVIDE KEYING INFORMATION.
4. CONTROL PANEL TO BE PROVIDED BY THE PUMP MANUFACTURER IN A NEMA 3R STAINLESS STEEL ENCLOSURE. CABINET TO BE ALUMINUM DEAD FRONT CONSTRUCTION WITH CONTINUOUS HINGE. THE CONTROL PANEL SHALL INCLUDE THE FOLLOWING: PHASE & POWER FAILURE PROTECTION, PUMP ALTERNATOR W/ALTERNATOR TEST, EMERGENCY GENERATOR CIRCUIT BREAKER WITH INTERLOCK, EMERGENCY GENERATOR PLUG-IN RECEPTACLE. THE PUMP CONTROL PANEL SHALL INCLUDE AN EMERGENCY GENERATOR RECEPTACLE. FOR STATIONS UTILIZING PUMPS SMALLER THAN 15hp, THE RECEPTACLE SHALL BE A MODEL JRE4100 AS MANUFACTURED BY PYLE NATIONAL. FOR STATIONS UTILIZING PUMPS 15hp AND LARGER THE RECEPTACLE SHALL BE A MODEL JRSB2044 AS MANUFACTURED BY RUSSELL-STOLL.  
D.C. ALARM WITH BATTERY & CHARGER, ALARM HORN, STROBE LIGHT AND ALARM SILENCER, ALARM TO BE ENERGIZED BY POWER/PHASE FAILURE OR HIGH WATER LEVEL FLOAT. DUPLEX 120V RECTACLE TO BE PROVIDED IN THE PANEL. SHOP DRAWINGS REQUIRED FOR APPROVAL.
5. POWER SOURCE TO BE 230 or 460v, 3 PHASE, 60 HZ. ALL WIRING AS PER N.E.C. as required.
6. ALL NUTS, BOLTS, WASHERS AND MISCELLANEOUS HARDWARE TO BE 316 STAINLESS STEEL IN VALVE VAULT, WET WELL AND THROUGHOUT STATION.
7. LIGHTNING ARRESTORS SHALL BE SQUARE D MODEL SDSA365 SERIES 001 .
8. QUICK DISCONNECT HOSE COUPLINGS SHALL BE 4" NOMINAL DIAMETER. THROUGH CAST IRON STREET BOXES. VALVES TO BE SUPPLIED WITH 2" OPERATOR NUTS AND "T" HANDLE OPERATOR WRENCHES. HANDLES SHALL PROJECT 3'-0" ABOVE FINISHED GRADE WHEN IN PLACE.
9. PLUG VALVES ON BY-PASS LINES SHALL BE BURIED WITH ACCESS
10. ALL WET WELL AND VALVE BOX CONSTRUCTION JOINTS TO BE SEALED WITH "RAM-NEK" TAPE AND ANYHDROUS CEMENT TO LEAK FREE STATE. PAINT OVER JOINTS W/"CARBOLINE" BITUMASTIC 300M EPOXY, 20 MIL.
11. A 6'-0" HIGH CHAIN LINK FENCE ENCLOSURE WITH 3 STRAND BARBED WIRE TOP AND DOUBLE GATES SHALL BE PROVIDED.
12. VALVE BOX HATCH TO BE 300# RATING. CONSTRUCTION AND MANUFACTURER AS SPECIFIED IN NOTE 3.
13. CAST IRON STREET BOXES SHALL BE AS MANUFACTURED BY "NEENAH" OR APPROVED EQUAL. BOXES TO BE ADJUSTABLE.
14. ALL EXPOSED & EMBEDDED CONDUITS TO BE SCHED. 80 PVC.
15. ALL EXPOSED CONCRETE, PIPE AND VALVES IN WET WELL AND VALVE VAULT TO BE PAINTED WITH BITUMASTIC 300M, 20 MIL.
16. GAUGES TO BE STAINLESS STEEL 0 - 50 LBS. LIQUID FILLED MOUNTED ON PIPE DOWNSTREAM FROM CHECK VALVE.
17. 316 STAINLESS STEEL WALL BRACKETS TO BE 1/4"x1" STAINLESS STEEL MATERIAL AND ANCHORED WITH 3"x3/8" STAINLESS STEEL BOLTS.
18. ACCESS TO LIFT STATION CONCRETE PAD SHALL BE 12' WIDE DRIVE STABILIZED WITH 6" THICK MILLING OR 1 1/4" ASPHALTIC CONCRETE.
19. ALL ELECTRICAL CONDUIT TO THE METER FROM THE POWER SOURCE SHALL BE EMBEDDED AS APPROVED BY THE CITY.
20. LIFT STATION START-UP TEST SHALL BE PROVIDED FOR FINAL APPROVAL BY THE CITY. IT SHALL BE THE CONTRACTORS' RESPONSIBILITY TO MAKE ARRANGEMENTS WITH THE POWER COMPANY TO OBTAIN TEMPORARY POWER FOR THE START-UP TEST AT NO COST TO THE CITY.
21. THE CONTROL PANEL IS TO INCLUDE A TERMINAL STRIP FOR CONNECTION TO A REMOTE TERMINAL UNIT (RTU).  
THE RTU SHALL HAVE A NEMA 3R STAINLESS ENCLOSURE WITH SINGLE POLE, 120V AC AND CIRCUIT BREAKER. AUXILIARY CONTACTS SHALL BE INCORPORATED IN THE CONTROL PANEL TO (A)TURN THE PUMPS ON OR OFF (B) SILENCE ALARM HORN FROM A REMOTE SIGNAL (C) MONITOR LIFT STATION STATUS AND CONTROL PROGRAM SUCH AS REMOTE ALARM NOTIFICATION, DATA/LOGGING AND REAL-TIME UPDATES. RTU SHALL BE ADJACENT TO THE EXISTING CONTROL PANEL.  
THE RTU SHALL BE DETERMINED BY THE CITY OF EUSTIS.  
THE RTU SHALL COMMUNICATE BY RADIO TO THE SCADA SYSTEM. THE SCADA H.M.I. WILL BE UPDATED TO MONITOR AND CONTROL THE LIFT STATION.
22. A GENERATOR WITH CONC. PAD MUST BE PROVIDED FOR THE LIFT STATION FOR EMERGENCY POWER SUPPLY.
23. SUPPLY ANDINSTALL AT THE LIFTSTATION SITE A NEPTUNE METER EZ-NET FIXED NETWORK DATA COLLECTION R-900 SYSTEM #12558-310, 110 VOLT AC, TIED TO LANDLINE TELEPHONE SERVICE.
24. THE CONTRACTOR SHALL PROVIDE A 20', 2" GALV. MAST FOR THE RADIO.

SITE WORK

WITHIN FENCED AREA AND AROUND CONCRETE PAD, REMOVE SOIL TO A DEPTH OF 6". SPRAY GROUND WITH A WEED INHIBITOR, INSTALL A WEED SCREEN AND COVER WITH 6" OF 1/2" SIZE RIVER GRAVEL.



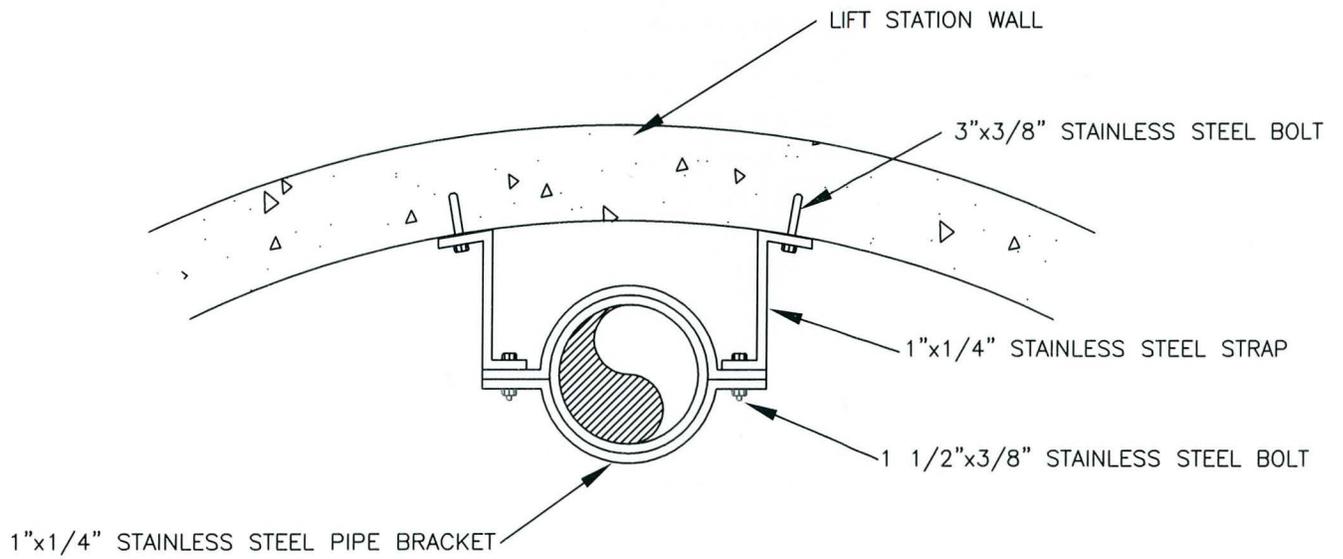
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LIFT STATION  
GENERAL NOTES

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**WALL BRACKET DETAIL**



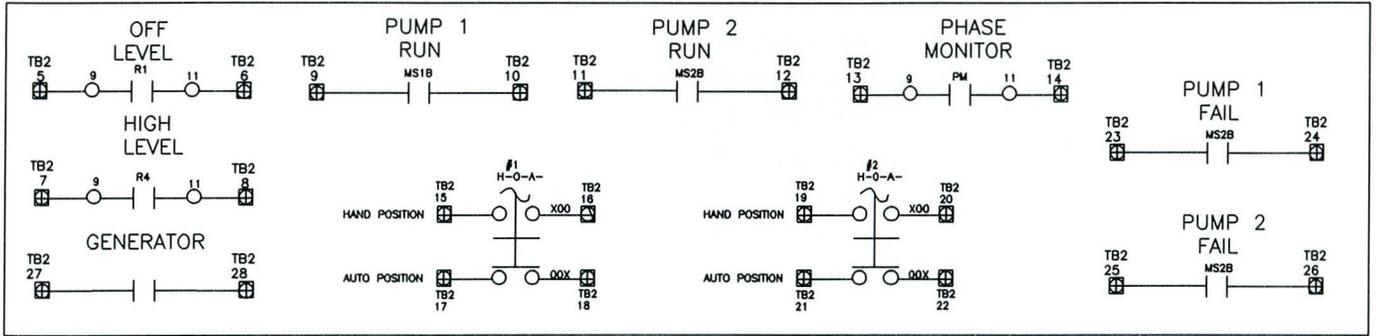
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WALL BRACKET DETAIL

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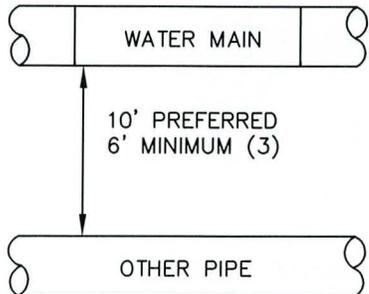
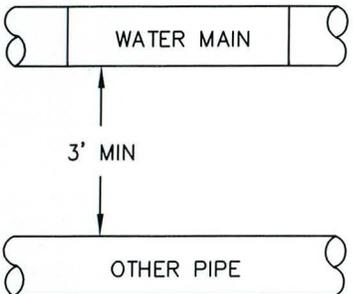
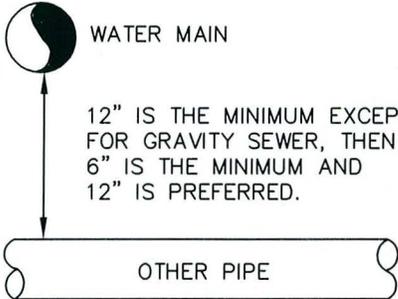
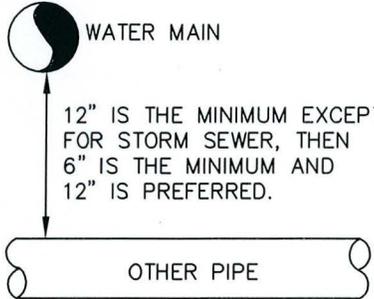
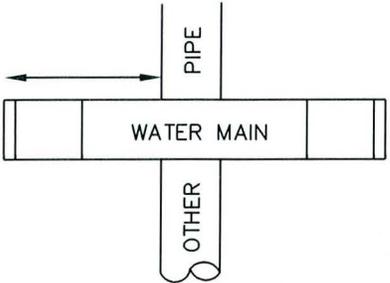
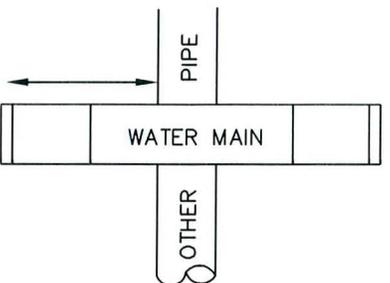
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RTU CONNECTIONS

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OTHER PIPE	(a) GRAVITY OR PRESSURE SANITARY SEWER (b) SANITARY SEWER FORCE MAIN (c) RECLAIMED WATER (4)	(a) STORM SEWER, (b) STORMWATER FORCE MAIN, (c) RECLAIMED WATER (2)	ON-SITE SEWAGE TREATMENT & DISPOSAL SYSTEM
HORIZONTAL SEPARATION			10' MIN.
CROSSINGS (1)			—
JOINT SPACING AT CROSSINGS (FULL JOINT CENTERED)	<p>ALTERNATE 6 FT MINIMUM</p> 	<p>ALTERNATE 3 FT MINIMUM</p> 	—

- (1) WATER MAIN SHOULD CROSS ABOVE OTHER PIPE. WHEN WATER MAIN MUST BE BELOW OTHER PIPE, THE MINIMUM SEPARATION IS 12 INCHES.
- (2) RECLAIMED WATER REGULATED UNDER PART III OF CHAPTER 62-610, F.A.C.
- (3) 3 FT FOR GRAVITY SANITARY SEWER WHERE THE BOTTOM OF THE WATER MAIN IS LAID AT LEAST 6 INCHES ABOVE THE TOP OF THE GRAVITY SANITARY SEWER.
- (4) RECLAIMED WATER NOT REGULATED UNDER PART III OF CHAPTER 62-610, F.A.C.

### PIPING CLEARANCES

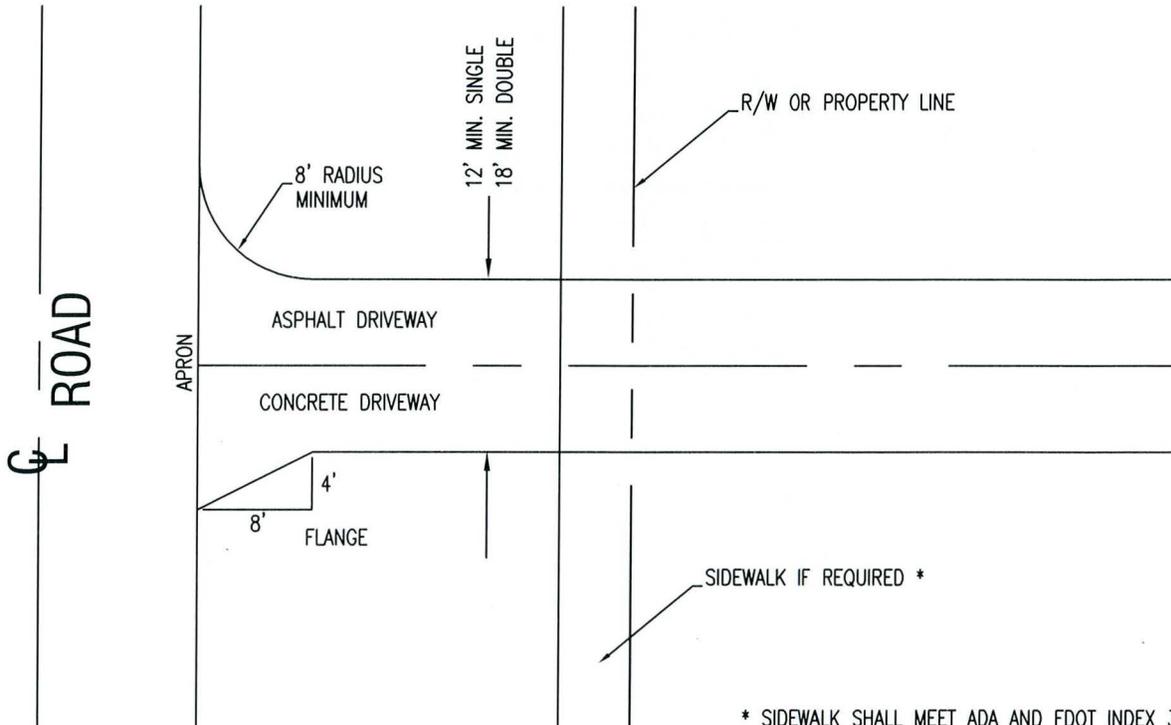


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PIPE CLEARANCES

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\* SIDEWALK SHALL MEET ADA AND FDOT INDEX 310 WITH 2% MAX CROSS SLOPE AND 5% RUNNING SLOPE

1. 1" ASPHALT W/ 6" COMPACTED LIMEROCK BASE OR 2. 6" 3000 PSI CONCRETE WITH FIBER OR 6" 3000 PSI CONCRETE REINFORCED W/ 10-10x6"x6" WIRE MESH ON 6" COMPACTED SUBGRADE

### RESIDENTIAL DRIVEWAY DETAIL



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RESIDENTIAL DRIVEWAY

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