I. GENERAL

The Department of Utility Services has developed a minimum standard for water and wastewater utility installation within Indian River County. The Water and Wastewater Utility Standards, July 2007 edition, has been adopted by the County Commission and henceforth all water and wastewater utility installations within Indian River County shall be designed and built in accordance therewith.

The minimum requirements provided herein may be modified on future developments upon approval of the Utility Director or the County Commission upon a finding that the public’s health and safety is not adversely affected by such modifications. Any proposed modification to the minimum requirements must be substantiated by a Florida Registered Engineer’s certified study, which would indicate compliance with the intent of the minimum requirements as herein provided.

The Department of Utility Services (Utility Department) reserves the right to impose additional field requirements not addressed herein, when in the opinion of the Utility Department, those requirements will improve the integrity of the utility system.
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SECTION 1

WATER MAINS
DUCTILE IRON PIPES AND FITTINGS
SECTION 1
WATER MAINS
DUCTILE IRON PIPES AND FITTINGS

1.01 SCOPE

This section covers cast ductile iron pipe and cast ductile iron fittings for water mains.

1.02 GENERAL

A. Ductile iron pipe (D.I.P.) shall be allowed for use as water pipe where compatible with the specific conditions of the project. The use of material other than ductile iron may be required by Indian River County Department of Utility Services (IRCDUS) during construction permit review or by IRCDUS field personnel during construction if it is determined that ductile iron pipe is unsuitable for the particular application.

B. All ductile iron pipe shall be manufactured in accordance with AWWA Specification C150 (A21.50-96), or latest revision and shall be pressure Class 300 or 350 minimum as depicted on Table 1.1 on page 1-2. All ductile iron pipe crossing under roadways and other trafficked areas shall be pressure class 350 minimum.

C. Unless specifically indicated otherwise, restrained joint underground piping shall be manufactured restrained bell and spigot and above ground piping shall be flanged.

D. Cutting of ductile iron pipe shall be by sawing only.

1.03 PIPE

Ductile iron pipe shall be bell and spigot cast in accordance with AWWA Specification C150 (ANSI A21.50-96), or latest revision. Cast ductile iron shall have a minimum tensile strength of 60,000 psi, with a minimum yield strength of 42,000 psi. Pipe wall thickness shall be computed in accordance with AWWA Specification C150 (ANSI A21.51-96), or latest revision, using the physical characteristics cited above, with a minimum working pressure of 200 psi and a Laying Condition “Type 2.” Unless otherwise indicated or specified herein, the pipe shall have the minimum wall thickness according to class designation for diameters shown. All pipe shall be given a minimum factory hydrostatic test of 500 pounds per square inch.
TABLE 1.1
PRESSURE CLASS

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<th>SIZE (INCHES)</th>
<th>OUTSIDE DIAMETER (INCHES)</th>
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1.04 FITTINGS

A. All underground fittings shall be either push on, restrained, or mechanical joint. Mechanical joints shall conform to AWWA Specification C110 (ANSI 21.10-98) or C153 (ANSI 21.53-00), or latest revisions. All aboveground fittings shall be flanged joint.

B. The pressure rating shall be 350 psi.

C. Joint restraint, when required. Shall be by Nappco C-1300 restrainer or approved equal.

D. All fittings shall be lined with the same material as specified for the pipe as per paragraph 1.05.

1.05 LINING AND COATING

A. Unless otherwise indicated, all ductile iron pipe shall be factory lined and coated.

B. Lining: All pipe shall be cement mortar lined and seal coated in accordance with AWWA Standard C104 (ANSI A21.4-95), or latest revision unless double lined is required by IRCDUS.
C. **Coating:** Unless specified otherwise, all pipe shall be bituminous coated outside to a dry film thickness of at least 1 mil.

D. **Repair:** Anywhere that the coating is removed purposely or accidentally, the area shall be cleaned of any rust, grease, and dirt and re-coated to a minimum dry film as specified for the individual piece.

E. **Encasement:** If and where directed by IRCDUS’s Engineer, a polyethylene encasement shall be provided around pipe, fittings, and valves. The material, installation, and workmanship shall conform to applicable sections of AWWA C105 (ANSI A21.5-99), or latest revision. Installation methods A or B shall be employed using flat tube polyethylene. The Contractor shall make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfilling following installation shall be completed without delay to avoid exposure to sunlight.

F. All exposed Ductile Iron pipe shall be coated with Duromar or approved equal. Ductile Iron water mains are to be painted blue.

1.06 **BELL AND SPIGOT CONNECTIONS**

Joints in bell and spigot pipe shall be push-on, mechanical, or restrained joints in accordance with AWWA Standard C111 (ANSI 21.11-00), or latest revision. Pipe restraints shall also be in accordance with IRCDUS Standards or as directed by IRCDUS’s Engineer.

1.07 **FLANGED CONNECTIONS**

A. All flanged pipe barrels shall comply with the physical and chemical requirements as set forth in the Handbook of Ductile Iron Pipe of the Cast Iron Pipe Research Association, latest revisions. Flanges shall be in accordance with ANSI Specification B16.1 for Class 125 flanges. Bolts shall comply with ANSI Specification B18.2.

B. Flanged pipe shall be faced and drilled to the American Standard Drilling, unless special drilling is called for or required. Where tap or stud bolts are required, flanges shall be tapped. Flanges shall be accurately faced and drilled smooth and true, at right angles to the pipe axis and shall be covered with zinc dust and tallow or a rust preventive compound immediately after facing and drilling.

C. Flanged pipe with screwed-on flanges shall be furnished with long hubs, and the flanges shall be screwed on the threaded end of the pipe in the shop, and the face of the flange and end of pipe refaced together. There shall be no leakage through the pipe threads and the flanges shall be designed to prevent corrosion of the threads from outside.
D. Flanged joints shall be made with bolts or stud bolts and nuts. Bolts, stud bolts, and nuts shall conform to American Standard heavy dimensions, semi-finished with square or hexagonal heads and cold punched hexagonal nuts, meeting the requirements of ASTM Designation A-307. Bolt sizes shall be American Standard for the flanges specified, and bolts and nuts shall have good, true threads.

E. Gaskets shall be in accordance with AWWA Standard C115 (ANSI A21.15-99), latest revision.

1.08 SUBMITTALS

Before starting fabrication of the ductile iron pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the Engineer. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions. The drawings submitted shall show flanged jointed sections placed so as to be removable without disturbance to the main pipe sections.

1.09 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See trace wire detail M-16 for specifications regarding installation.

B. Trace wire is required over all pipes or as required by IRCDUS.

C. Location tape is required over all pipes. Tape is to be installed 12" below proposed grade.

1.10 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer’s instructions and with the applicable provisions of AWWA C600-99, or latest revision. If a conflict exists between the manufacturer’s instructions and the AWWA Standards, the manufacturer’s instructions shall govern. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment. All piping shall be placed in a dry trench, unless the IRCDUS’s Engineer approves wet trench installation.
B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer or his representative. Engineer reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no cost to the IRCDUS.

END OF SECTION
SECTION 2

WATER MAINS
POLYVINYL CHLORIDE PIPE AND FITTING
SECTION 2
WATER MAINS
POLYVINYL CHLORIDE PIPE AND FITTINGS

2.01  SCOPE

This section covers polyvinyl chloride pipe and fittings for potable water mains.

2.02  GENERAL

Polyvinyl chloride (PVC) pipe shall be allowed for use as potable water pipe where compatible with the specific conditions of the project. Indian River County Department of Utility Services (IRCDUS) may require the use of material other than polyvinyl chloride during construction permit review or by IRCDUS field personnel during construction if it is determined that polyvinyl chloride pipe is unsuitable for the particular application.

2.03  PIPE MATERIALS FOR SIZES 3” and SMALLER

A. All pipe and fittings intended for conveying or transmitting potable water shall be designed for a minimum working pressure of 150 psi.

B. Polyvinyl chloride pressure pipe shall conform to the ASTM 2241, latest revision. Pipe shall be SDR 21 with a pressure rating of 200 psi. Joint design tested to the requirements of ASTM D 3139. Rubber rings shall conform to ASTM F 477 and D 1869. Pipe to be made to exceed the requirements of the material section of ASTM D 2241.

C. Polyvinyl chloride pipe per Approved Manufacturer’s Product List.

D. The pipe shall be blue in color.

E. No solvent welds joints are permitted.

2.04  PIPE MATERIALS FOR SIZES 4” THROUGH 12”

A. All pipe and fittings intended for conveying or transmitting potable water shall be designed for a minimum working pressure of 150 psi.

B. Polyvinyl chloride pressure pipe shall conform to the latest AWWA Standard Specifications C900-97, or latest revision, or C909-98, or latest revision and ASTM D1784 and D2241,
latest revision. PVC pressure pipe shall be made from Class 12454-A or Class 12454-B material and conform to the outside diameter of cast iron pipe with a minimum wall thickness of DR18.

C. Polyvinyl chloride pipe per Approved Manufacturer's Product List.

D. The pipe shall be blue in color.

2.05 PIPE MATERIALS FOR SIZES 14” THROUGH 36”

A. All pipe and fittings intended for conveying or transmitting potable water shall be designed for a minimum working pressure of 150 psi.

B. Polyvinyl chloride pressure pipe shall conform to the latest AWWA Standard Specifications C905-97 and ASTM D1784, or latest revisions. PVC pressure pipe shall be made from Class 12454-A or Class 12454-B material and conform to the outside diameter of cast iron pipe with a minimum wall thickness of DR18.

C. Polyvinyl chloride pipe per Approved Manufacturer's Product List.

D. The pipe shall be blue in color.

2.06 JOINTS

A. Joints for PVC pressure pipe shall be bell and spigot push-on rubber gasket type only. No solvent weld or threaded joints will be permitted.

B. The IRCDUS’s Engineer may consider other type joints for specific installation upon submission of specifications and approval.

C. Restraint joints, when required; see Approved Manufacturer’s Product List.

2.07 FITTINGS

A. All fittings shall be ductile iron mechanical joint and shall conform to AWWA Standard Specifications C110/A21.10-98 or C153/A 21.53-00, or latest revisions. Fittings shall be cement mortar lined and seal-coated in accordance with AWWA Standard Specifications C104/A21.4-95, or latest revision.
B. The pressure rating shall be 350 psi.

C. Joint restraint, when required; see Approved Manufacturer’s Product List.

2.08 SUBMITTALS

Before starting installation of the PVC pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the IRCDUS’s Engineer Of record and IRCDUS. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions. The drawings submitted shall show flanged jointed sections placed so as to be removable without disturbance to the main pipe sections.

2.09 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See trace wire Detail M-14 for specifications regarding installation.

B. Trace wire is required over all pipes.

C. A 2” wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12” below proposed finished grade.

2.10 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer’s instructions and with the applicable provisions of AWWA Standard Specifications C605-94, or latest revision. If a conflict exists between the manufacturer’s instructions and the AWWA Standard Specifications, the manufacturer’s instructions shall govern. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment. All piping shall be placed in a dry trench, unless the Engineer of Record and IRCDUS approves wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the IRCDUS, all pipe shall have a minimum depth of cover of 36 inches. Contractor shall determine top of pipe elevation and top of finished grade elevation for every two joints of pipe installed using a level. Pipe
must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer or his representative. Engineer reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements.

END OF SECTION
SECTION 3

WATER SERVICES
POLYETHYLENE TUBING

AND

PRESSURE POLYETHYLENE PIPES
SECTION 3
WATER SERVICES
POLYETHYLENE (PE) TUBING & PRESSURE PIPES

3.01 SCOPE FOR POLYETHYLENE TUBING

This section covers polyethylene pipes and fittings for water services.

3.02 POLYETHYLENE TUBING 3 INCHES IN DIAMETER AND SMALLER

A. Polyethylene tubing shall comply with applicable requirements for PE 3408 extrusion compound polyethylene plastic material as stated in AWWA Standard Specifications C901-96, or latest revision, and shall comply with the following:

1. Tubing shall have a working pressure of 200 psi at 73.4° F.

2. Tubing surfaces shall be glass smooth, and shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.

3. Tubing dimensions and tolerances shall correspond with the values listed in ASTM D-2239, with a standard dimension ratio (SDR) of 9.

4. Tubing shall be fully labeled with brand name and manufacturer, NSF seal, size, type of plastic material, and ASTM designation with which the tubing complies.

3.03 JOINTS

A. Joints for polyethylene tubing shall be of the compression type, utilizing a totally confined grip seal and coupling nut. Stainless steel tube stiffener inserts shall also be used for PE tubing services.

B. Other type joints may be considered for specific installations upon submission of specifications and approval by IRCDUS.

3.04 INSTALLATION

A. Backfill shall be free of rocks and debris.

B. Bending radius shall be large enough so that tubing is not crimped or damaged and so that the flow of water is not restricted. Manufacturer’s minimum radius recommendations are to be utilized during installation of PE tubing.
3.05 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See trace wire Detail M-16 for specifications regarding installation.

B. Trace wire is required over all pipes.

C. A 2" wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12" below proposed grade.

3.06 SCOPE FOR POLYETHENE (PE) PIPES

This section covers Polyethylene (PE) pipe and fittings.

3.07 GENERAL

A. Polyethylene (PE) pipe shall be allowed for use as all pressure utility pipes where compatible with the specific conditions of the project. The use of material other than PE pipe may be required by IRCDUS during construction permit review or by IRCDUS field personnel, if it is determined that PE is unsuitable for the particular application.

B. Documentation from the resin’s manufacturer showing results of the following tests for resin identification:

1. Melt Flow Index ASTM D 1238
2. Density ASTM D 1505

C. All PE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable and qualified in the manufacturing of the PE pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications. See Approved Manufacturer’s Product List.

D. Finished Product Evaluation

1. Production staff for the items listed below shall check each length of pipe produced. The results of all measurements shall be recorded on production sheets that become part of the manufacturer’s permanent records.
   a. Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.)
   b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with
ASTM F714 or ASTM D-3035 whichever is applicable.

c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714 or ASTM D-3035, whichever is applicable.

d. Pipe length shall be measured.

e. Pipe marking shall be examined and checked for accuracy.

f. Pipe ends shall be checked to ensure they are cut square and clean.

g. Subject inside surface to a “reverse bend test” to ensure the pipe is free of oxidation (brittleness).

E. Stress Regression Testing

1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacturing of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

F. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

G. The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten (10) years after the final acceptance of the project by the IRCDUS. The manufacturer shall replace at no expense to the IRCDUS any defective pipe material including labor within the warranty period.

3.08 MATERIALS FOR PIPE SIZES 4” AND LARGER

A. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 polyethylene resin compound meeting cell classification 334434D per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1248

B. Polyethylene (PE) pipe shall comply with AWWA Standard Specifications C906-99.

C. If rework compounds are required, only those generated in the Manufacturer’s own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
D. Dimensions and workmanship shall be as specified by ASTM F714. PE fittings and transitions shall meet ASTM D3261. PE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All PE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

E. PE pipe and accessories 3” and greater in diameter, shall be 160 psi at 73.4° F meeting the requirements of Standard Dimension Ratio (SDR) 11 as MINIMUM STRENGTH.

F. The pipe manufacturer must certify compliance, with the above requirements.

3.09 MATERIALS FOR PIPE SIZES 3” AND UNDER

A. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 polyethylene resin compound meeting cell classification 345434C per ASTM D3350; and meeting Type 111, Class C, Category 5, Grade P34 per ASTM D1248.

B. Polyethylene (PE) pipe shall comply with AWWA Standard Specifications C901-96.

C. If rework compounds are required, only those generated in the Manufacturer’s own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

D. Dimensions and workmanship shall be as specified by ASTM D-3035. PE fittings and transitions shall meet ASTM D3261. PE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All PE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

E. PE pipe and accessories 3” and greater in diameter, shall be 160 psi at 73.4° F meeting the requirements of Standard Dimension Ration (SDR) 11 as minimum strength.

F. The pipe manufacturer must certify compliance with the above requirements.

3.10 FITTINGS

A. All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Engineer.
B. The manufacturer of the PE pipe shall supply or specify all PE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.

C. All transition from PE pipe to PVC or ductile iron shall be made per the PE, PVC, or ductile iron pipe manufacturer’s recommendations and specifications whichever is more stringent. A molded flange connector adapter within a carbon steel back-up ring assembly shall be used for pipe type transitions. Ductile iron back-up rings shall mate with cast iron flanges per ANSI B16.1. A 316 stainless steel back-up ring shall mate with a 316 stainless flange per ANSI B16.1.

D. The pipe manufacturer must certify compliance with the above requirements.

3.11 JOINTING METHOD

A. The PE pipe shall be joined with butt, heat fusion joints. All joints shall be made in strict compliance with the manufacturer's recommendations.

B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipe so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying length’s not to exceed 50 feet.

C. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer’s specified torques. Bolts shall be tightened alternatively and evenly.

3.12 PIPE IDENTIFICATION

A. The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-ft.

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size.
3. Dimension ratio.
4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248, followed by the hydrostatic design basis in 160’s of psi, e.g., PE 3408.
5. Manufacturing standard reference, e.g., ASTM F714 or D-3035, as required.
6. A production code from which the date and place of manufacture can be determined.

B. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of all pipe and fittings. See Trace Wire Detail M-16 for specifications regarding installation.

3.13 INSTALLATION BY OPEN CUT METHOD

A. Polyethylene (PE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall do all heat fusion joints.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe. Pipe or fitting shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer of Record and IRCDUS. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.

C. Under no circumstances shall the pipe or accessories be dropped into the trench.

D. Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.

E. Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.

F. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

G. Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.
H. Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings.

I. When installation of pipe is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.

J. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. Sections of pipe with cuts, scratches or gouges exceeding five percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined. The interior pipe surface shall be free of cuts, gouges or scratches.

K. The pipe shall be joined by the method of thermal butt fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer’s recommendations.

L. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:

1. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe. A stainless steel or ductile iron back-up ring shall be used on both sides of the connection prior to thermally butt-fusing the polyethylene flange.
2. A 316 stainless steel back-up ring shall mate with a 316 stainless steel flange.
3. Ductile iron back-up rings shall mate with cast iron flanges.

M. Flange connections shall be provided with a full-face neoprene gasket.

N. All PE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

O. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

P. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before
installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

Q. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. The pipe manufacturer’s representative prior to use shall approve equipment used in compacting the initial 3-ft of backfill.

R. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing of utilities that may be encountered upon opening the trench.

S. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be “pulled” or “cramped.”

T. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

U. Precautions shall be taken to prevent flotation of the pipe in the trench.

V. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be used in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below the top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be
placed to fill any voids created and the backfill shall again be compacted to provide uniform side support for the pipe.

W. Unless otherwise approved concrete thrust blocks shall be installed at all fittings and other locations as directed by the Engineer. Minimum bearing area shall be as shown on the Drawings. Concrete shall be placed against undisturbed material and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

X. Restrained joints shall be installed where shown on the Drawings, required by IRCDUS Standards, or as directed by the Engineer.

### 3.14 MARKING FOR OPEN CUT METHOD

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See trace wire Detail M-16 for specifications regarding installation.

B. Trace wire is required over all pipes.

C. A 2” wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12” below proposed finished grade.

### 3.15 TRENCHLESS INSTALLATION OF PRESSURE MAINS BY DIRECTIONAL BORING

A. **DESCRIPTION**

   1. Portions of the pressure mains shall be installed by the directional bore method within the limits indicated of the contract plans and as specified herein. Generally, as a minimum, the pressure main is to be located within the road right-of-way and shall be installed by directional boring.
   2. This section includes material, performance and installation standards, and the contractor’s responsibilities associated with the furnishing of labor, material, equipment, and identical required to install, complete, required trenchless installation of pressure mains, as shown on the Drawings and as specified herein.

B. **EXPERIENCE**

   1. The Contractor must demonstrate expertise in trenchless method by providing a list of ten (10) utility references for which similar work has been preformed in the last two years. The references should include a name and phone number where the contact can be made to verify the contractor’s capability. The contractor must provide documentation
showing successful completion of the projects used for reference. Conventional trenching experience will not be considered applicable.

2. Supervisory personnel must be adequately trained and shall have at least four (4) years experience in directional boring. The Contractor shall submit the names and resumes of all supervisory field personnel prior to construction.

3. Because of time constraints, the Contractor may wish to provide multiple experienced directional boring crews.

4. Directional boring equipment shall be capable of installing the minimum pipe diameter noted on the drawings.

B. SUBMITTALS

1. Submit technical data for equipment including clay slurry material, method of installation with working drawings, and proposed sequence of construction for approval by the Engineer.

2. Prior approval for directional boring, the Contractor must submit the names of supervisory personnel, and history information of the directional boring experience. In addition, the Contractor must submit for approval the nameplate, data for the drilling equipment, mobile spoils removal units and Material Safety Data Sheets (MSDS) information for the drilling slurry compounds.

3. The Contractor is required to bring to the attention of the engineer any known design discrepancies with actual tunneling methods that the contractor will be performing. This shall be stated in writing to the Engineer at the pre-construction meeting.

C. INSTALLATION

1. Installation shall be in a trenchless manner producing continuous bores.

2. The tunneling system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. Accurate placement of pipe within a +/- 2-inch window is required both horizontally and vertically. Turning capability of 90-degrees radius in 40 feet is required. Continuous monitoring of the boring head is required, including across open water if necessary.

3. The directional boring Contractor shall submit certification, by a Professional Engineer licensed in the State of Florida, that the directional boring has been performed in accordance to the construction drawings, and shall submit signed and sealed drawings. Record Drawings (As-Built) shall provide both in both electronic format and hard paper copy.
4. Tunneling shall be preformed by a fluid-cutting process (high pressure-low volume) utilizing liquid clay i.e. bentonite. The clay lining will maintain tunnel stability and provide lubrication in order to reduce frictional drag while the pipe is being installed. In addition, the clay fluid must be totally inert and contain no environmental risk. The Contractor must also have a mobile vacuum spoils recovery vehicle on site to remove the drilling spoils from the access pits. The spoils must then be transported from the job site and be properly disposed off the site. The drilling spoils shall not, under any circumstances, be disposed into a sanitary sewer, storm, or other public or private drainage system. Spoils may be transported to the County’s Solid Waste Facility and the cost of disposal shall be by the County.

5. Liquid clay type colloidal drilling fluid shall consist of at least 10 percent of high-grade carefully processed bentonite to consolidate cuttings of the soil, to seal the walls of the hole, and to furnish lubrication for subsequent removal of cuttings. The slurry that is heavier than the surrounding material, is high in colloids of the bentonite type and it will deposit a thin filter cake of low permeability material on the walls of the bore. This will allow only a small amount of the fluid to pass into the surrounding soils and will stabilize the bore. The colloidal content of the fluid imparts excellent lubricating qualities to the slurry that is a distinct aid to the removal of the soil cuttings.

6. Pneumatic or water-jetting methods will be considered unacceptable due to the possibility of surface subsidence.

7. After an initial bore has been completed, a reamer will be installed at the termination pit and the pipe shall be pulled back to the starting pit. The reamer shall be capable of discharging liquid clay to facilitate the installation of the pipe into a stabilized and lubricated tunnel.

8. A minimum of two (2) insulated #6 stranded tracer wire shall be installed along with the PE pipe. The tracer wire shall be tested for continuity upon completed installation. Should both tracer wires fail to test for continuity then the test shall be considered a failure and the wires shall be replaced. Tracing wires, #10 stranded conductor copper, shall be wrapped or affixed to the top of the pipe and fittings.

9. Upon completion of boring and pipe installation, the Contractor shall remove all spoils from the starting and termination pits. All pits shall be restored to their original condition.

10. The shoulders, ditches, banks, and slopes of roads and railroads crossed and paralleled shall not wash out before becoming consolidated. Restoration shall be as required by the jurisdictional authority and as specified within the Contract Document.

END OF SECTION
SECTION 4

GRAVITY SANITARY SEWERS
DUCTILE IRON PIPE
SECTION 4

GRAVITY SANITARY SEWERS
DUCTILE IRON PIPE

4.01 SCOPE

This section covers ductile iron pipe and fittings for gravity sanitary sewers.

4.02 GENERAL

A. Ductile iron pipe shall be allowed for use as gravity sewer pipe where compatible with the specific conditions of the project. The use of material other than ductile iron may be required by Indian River County Department of Utility Services (IRCDUS) during construction permit review or by IRCDUS field personnel during construction if it is determined that ductile iron pipe is unsuitable for the particular application.

B. All ductile iron pipes shall be manufactured in accordance with AWWA Standard Specifications C150/A21.50-96 and C151/A21.51-96, or latest revisions, and shall be pressure Class 300 or 350 minimums, as depicted on Table 4.1 on page 4-2. All ductile iron pipe crossing under roadways shall be pressure Class 350 minimum.

C. Unless specifically indicated otherwise, underground piping shall be bell and spigot, mechanical joint, or restrained joint and aboveground piping shall be flanged.

D. Cutting of ductile iron pipe shall be by sawing only.

4.03 PIPE

Ductile iron pipe shall be bell and spigot cast in accordance with the latest AWWA Standard Specifications C150/A21.50-96 and C151/A21.51-96. Cast ductile iron shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Pipe wall thicknesses shall be computed in accordance with AWWA Standard Specifications C150/A21.50-96, using the physical characteristics cited above with a minimum working pressure of 200 psi and a Laying Condition “Type 2.” Unless otherwise indicated or specified herein, the pipe shall have the minimum wall thickness according to class designation for diameters shown. All pipes shall be given a minimum factory hydrostatic test of 500 psi.
4.04 FITTINGS

A. All underground fittings shall be either push-on, restrained, or mechanical joint. Mechanical joints shall conform to AWWA Standard Specifications C110/A21.10-98 or C153/A21.53-00, or latest revisions. All aboveground fittings shall be flanged joint.

B. The pressure rating shall be 350 psi.

C. All fittings shall be lined with the same materials as specified for the pipe, as per paragraph 4.05.

4.05 LINING AND COATING

A. Unless otherwise indicated, all ductile iron pipe shall be factory lined and coated.

B. Lining: For 4” and larger, the interior of the pipe shall have a fusion-bonded ceramic epoxy lining. The epoxy material shall be applied in 1 coat with a minimum dry film thickness of 40.0 mils and shall be per the Approved Manufacturer’s Products List. If and where directed by the Engineer of Record and the IRCDUS, a polyethylene encasement shall be provided over pipe and fittings.

C. Coating: Unless otherwise specified, the exterior of the pipe shall have a bituminous coating to a minimum dry film thickness of 1.0 mil. See Approved Manufacturer’s Products List for coating material.
D. **Lining Inspection:**
1. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined SSPC-PA-2 film thickness rating.
2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500-volt test.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date.

E. **Certification of Lining Inspection:** The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified, and that the material was applied as required by the specification.

F. **Repair:** Anywhere that the coating is removed purposely or accidentally, the area shall be cleaned of any rust, grease, and dirt and re-coated to a minimum dry film as specified for the individual piece.

G. **Encasement:** If and when directed by the Engineer of Record and IRCDUS, a polyethylene encasement shall be provided around pipe, fittings, and valves. The material, installation, and workmanship shall conform to applicable sections of AWWA Standard Specifications C105/A21.5-99, or latest revision. Installation methods A or B shall be employed using flat tube polyethylene. The Contractor shall make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfilling following installation shall be completed without delay to avoid exposure to sunlight.

H. All exposed sewer ductile iron pipe shall be coated (painted) green per approved manufacturer’s Product List.

4.06 **BELL AND SPIGOT CONNECTIONS**

Joints in bell and spigot pipe shall be push-on, mechanical, or restrained joints in accordance with AWWA Standard Specifications C111/A21.11-00, or latest revision. Pipe restraints shall also be in accordance with IRCDUS Standards or as directed by Engineer or IRCDUS.

4.07 **FLANGED CONNECTIONS**

A. All flanged pipe barrels shall comply with the physical and chemical characteristics (requirements) as set forth in the Handbook of Ductile Iron Pipe Research Association, latest
revisions. Flanges shall be in accordance with ANSI Specification B16.1 for Class 125 flanges. Bolts shall comply with ANSI Specification B18.2.

B. Flanged pipe shall be faced and drilled to the American Standard Drilling, unless special drilling is called for or required. Where tap or stud bolts are required, flanges shall be tapped. Flanges shall be accurately faced and drilled smooth and true, at right angles to the pipe axis, and shall be covered with zinc dust and tallow or a rust preventive compound immediately after facing and drilling.

C. Flanged pipe with screwed-on flanges shall be furnished with long hubs, and the flanges shall be screwed on the threaded end of the pipe in the shop, and the face of the flange and end of pipe refaced together. There shall be no leakage through the pipe threads and the flanges shall be designed to prevent corrosion of the threads from outside.

D. Flanged joints shall be secured with bolts or stud bolts and nuts. Bolts, stud bolts, and nuts shall conform to American Standard heavy dimensions, semi-finished with square or hexagonal heads and cold punched hexagonal nuts, meeting the requirements of ASTM Designation A-307. Bolt sizes shall be American Standard for the flanges specified, and bolts and nuts shall have good, true threads.

E. Gaskets shall be in accordance with AWWA Standard Specifications C115/A21.15-99, or latest revision.

4.08 SUBMITTALS

Before starting fabrication of the ductile iron pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the Engineer or IRCDUS. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions. The drawings submitted shall show flanged jointed sections placed so as to be removable without disturbance to the main pipe sections.

4.09 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Detail M-14 for specifications regarding installation.

B. Trace wire is required over all pipes.

C. A 2" wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12" below proposed finished grade.
4.10 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer's instructions. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering. All piping shall be placed in a dry trench, unless the Engineer or IRCDUS approves wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer. Engineer reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no cost to the Owner.

END OF SECTION
SECTION 5

GRAVITY SANITARY SEWERS
POLYVINYL CHLORIDE PIPE
SECTION 5

GRAVITY SANITARY SEWERS
POLYVINYL CHLORIDE PIPE

5.01 SCOPE

This section covers polyvinyl chloride pipe and fittings for gravity sanitary sewers.

5.02 GENERAL

A. Polyvinyl chloride (PVC) pipe shall be allowed for use as gravity sewer pipe where compatible with the specific conditions of the project. Indian River County Department of Utility Services (IRCDUS) may require the use of material other than polyvinyl chloride during construction permit review or by IRCDUS field personnel during construction if it is determined that polyvinyl chloride pipe is unsuitable for the particular application.

B. Polyvinyl chloride (PVC) gravity sewer pipe can be used up to a depth of sixteen feet as specified herein. Ductile iron pipe shall be used for depths greater than 16 feet, except where other material is specifically specified and approved by IRCDUS’s Engineer.

5.03 GRAVITY SEWER PIPE AND FITTINGS

A. Gravity sewers lines and laterals shall be extra strength polyvinyl chloride pipe and shall conform to the latest ASTM Designation D3034-SDR26. Fittings installed in polyvinyl chloride pipe shall conform to the same specifications as the pipe in which they are installed.

B. In addition to the requirements of ASTM specifications, the pipe shall not be out-of-round or crooked in alignment as determined by the Engineer. Any length of pipe 6 inches or greater in diameter whose inside diameters measured at right angles to each other vary more than ¼ inch may be rejected.

C. Polyvinyl chloride pipe shall be a maximum of 20 feet in length and shall be on the Approved Manufacturer’s Product List.

D. Material shall meet or exceed the requirements of ASTM Designation 1784, Type 1, Grade 1 (12454-B). All P.V.C. materials shall be stored in accordance with the manufacturer’s specifications (not in direct sunlight). PVC pipe and fittings, which show signs of ultraviolet degradation,
are considered substandard and unfit for use, and will be rejected by the IRCDUS’s Engineer.

E. All wyes, fittings, laterals, and manhole couplings shall be manufactured by same manufacturing company as the pipe or approved equal, see Approved Manufacturer’s Product List. Adapters shall be compatible to the approved pipe and appurtenances. All joints shall be rubber gasketed.

F. The pipe shall be green in color.

5.04 PIPE JOINT SEALS

A. Joint seals in polyvinyl chloride pipe and fittings shall comply with ASTM Designation D3212.

B. The joint shall remain sealed by its own compression. Adhesives shall not be necessary to weld or fuse the gaskets together.

C. The compressive stress which is developed in the gasket material shall be as high as is permitted by the strength of the bell in ring tension, with due regard to factor of safety, and this stress shall be at its maximum value when the joint is completely assembled.

5.05 RETROFITTING SEWER LATERALS

Gravity sewer systems shall be designed such that laterals are provided to serve all units and lots. In cases where sewer laterals must be added to a gravity sewer main, connections shall be made by installing a sewer service wye branch and a sleeve-type adapter, whichever is specified by IRCDUS for the particular application.

5.06 SUBMITTALS

Before starting fabrication of the PVC pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the Engineer or IRCDUS. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions.

5.07 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See trace wire Detail M-16 for specifications regarding installation.

B. Trace wire is required over all pipes.
C. A 2” wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12” below proposed grade.

5.08 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer’s instructions. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment at no additional cost to the Owner. All piping shall be placed in a dry trench, unless the Engineer or IRCDUS approves wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it meets these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer. Engineer reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no additional cost to the Owner.

END OF SECTION
SECTION 6

WASTEWATER AND RECLAIMED WATER FORCE MAINS
DUCTILE IRON PIPE AND FITTINGS
SECTION 6
WASTEWATER AND RECLAIMED WATER FORCE MAINS
DUCTILE IRON PIPE AND FITTINGS

6.01 SCOPE

This section covers cast ductile iron pipe and fittings for wastewater and reclaimed water force mains.

6.02 GENERAL

A. Ductile iron pipe shall be allowed for use as wastewater and reclaimed water force main pipe where compatible with the specific conditions of the project. The use of material other than ductile iron may be required by Indian River County Department of Utility Services (IRCDUS) during construction permit review or by IRCDUS field personnel during construction if it is determined that ductile iron pipe is unsuitable for the particular application.

B. All ductile iron pipes shall be manufactured in accordance with AWWA Standard Specifications C150/A21.50-96 and C151/A51-96, or latest revisions, and shall be pressure Class 300 or 350 minimum as depicted on Table 6.1 on page 6-2. All ductile iron pipes crossing under roadways shall be pressure Class 350 minimum.

C. Unless specifically indicated otherwise, underground piping shall be bell and spigot and aboveground piping shall be flanged.

D. Cutting of ductile iron pipe shall be by sawing.

6.03 PIPE

Ductile iron pipe shall be bell and spigot cast in accordance with AWWA Standard Specifications C150/A21.50-96 and C151/A51-96, or latest revisions. Cast ductile iron pipe shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Pipe wall thicknesses shall be computed in accordance with AWWA Standard Specification C150/A21.50-96, or latest revision, using the physical characteristics cited above with a minimum working pressure of 200 psi and a Laying Condition “Type 2.” Unless otherwise indicated or specified herein, the pipe shall have the minimum wall thickness according to class designation for diameters shown. All pipe shall be given a minimum factory hydrostatic test of 500 pounds per square inch.
6.04 FITTINGS

A. All underground fittings shall be either push-on, restrained, or mechanical joint. Mechanical joints shall conform to AWWA Standard Specification C110/A21.10-98) or C153/A21.53-00), or latest revisions. All aboveground fittings shall be flanged joint.

B. The pressure rating shall be 350 psi.

C. All fittings shall be lined with the same material as specified for the pipe, as per paragraph 6.05.

6.05 LINING AND COATING

A. Unless otherwise indicated, all ductile iron pipes shall be factory lined and coated.

B. Lining: For 4” and larger, the interior of the pipe shall have a fusion-bonded ceramic epoxy lining. The epoxy material shall be applied in 1 coat with a minimum dry film thickness of 40.0 mils, see Approved Manufacturer’s Product List. If and where directed by IRCDUS, a polyethylene encasement shall be provided over pipes and fittings.
C. **Coating:** Unless otherwise specified, the exterior of the pipe shall have a bituminous coating to a minimum dry film thickness of 1.0 mil.

D. **Lining Inspection:**
1. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined SSPC-PA-2 film thickness rating.
2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500-volt test.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date.

E. **Certification of Lining Inspection:** The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified, and that the material was applied as required by the specification.

F. **Repair:** Anywhere that the coating is removed purposely or accidentally, the area shall be cleaned of any rust, grease, and dirt and re-coated to a minimum dry film as specified for the individual piece.

G. **Encasement:** If and when directed by IRCDUS’s Engineer, a polyethylene encasement shall be provided around pipe, fittings, and valves. The material, installation, and workmanship shall conform to applicable sections of AWWA Standard Specifications C105/A21.5-99, or latest revision. Installation methods A or B shall be employed using flat tube polyethylene. The Contractor shall make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfilling following installation shall be completed without delay to avoid exposure to sunlight.

H. All exposed ductile iron pipes shall be painted green per Approved Manufacturer’s Product List.

### 6.06 BELL AND SPIGOT CONNECTIONS

Joints in bell and spigot pipe shall be push-on, mechanical, or restrained joints in accordance with AWWA Standard Specifications C111/A21.11-00, or latest revision. Pipe restraints shall also be in accordance with IRCDUS Standards or as directed by IRCDUS’s Engineer.
6.07 FLANGED CONNECTIONS

A. All flanged pipe barrels shall comply with the physical and chemical requirements as set forth in the Handbook of Ductile Iron Pipe Research Association. Flanges shall be in accordance with ANSI Specification B16.1 for Class 125 flanges. Bolts shall be stainless and comply with ANSI Specification B18.2.

B. Flanged pipes shall be faced and drilled to the American Standard Drilling, unless special drilling is called for or required. Where tap or stud bolts are required, flanges shall be tapped. Flanges shall be accurately faced and drilled smooth and true, at right angles to the pipe axis, and shall be covered with zinc dust and tallow or a rust preventive compound immediately after facing and drilling.

C. Flanged pipe with screwed-on flanges shall be furnished with long hubs, and the flanges shall be screwed on the threaded end of the pipe in the shop and the face of the flange and end of pipe refaced together. There shall be no leakage through the pipe threads and the flanges shall be designed to prevent corrosion of the threads from outside.

D. Flanged joints shall be made with bolts or stud bolts and nuts. Bolts, stud bolts, and nuts shall conform to American Standard heavy dimensions, semi-finished with square or hexagonal heads and cold punched hexagonal nuts, meeting the requirements of ASTM Designation A-307. Bolt sizes shall be American Standard for the flanges specified, and bolts and nuts shall have good, true threads.

E. Gaskets shall be in accordance with AWWA Standard Specifications C115/A21.15-99, or latest revisions.

6.08 SUBMITTALS

Before starting fabrication of the ductile iron pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the Engineer and IRCDS. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions. The drawings submitted shall show flanged joined sections placed so as to be removable without disturbance to the main pipe sections.

6.09 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Detail M-16 for specifications regarding installation.
B. Trace Wire is required over all pipes.

C. A 2” wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12” below proposed finished grade.

6.10 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer's instructions. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment at no additional cost to the IRCDUS. All piping shall be placed in a dry trench, unless the Engineer and IRCDUS approves wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer. Engineer reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no cost to the Owner.

END OF SECTION
SECTION 7

WASTEWATER AND RECLAIMED WATER FORCE MAINS
POLYVINYL CHLORIDE PIPE
SECTION 7

WASTEWATER AND RECLAIMED WATER FORCE MAINS
POLYVINYL CHLORIDE PIPE

7.01 SCOPE

This section covers polyvinyl chloride pipe and fittings for wastewater and reclaimed water force main.

7.02 GENERAL

Polyvinyl chloride (PVC) pipe shall be allowed for use as wastewater and reclaimed water force main pipe where compatible with the specific conditions of the project. Indian River County Department of Utility Services (IRCDUS) may require the use of material, other than polyvinyl chloride, during construction permit review or by IRCDUS field personnel during construction if it is determined that polyvinyl chloride pipe is unsuitable for the particular application.

7.03 PIPE MATERIALS FOR SIZES 4” THROUGH 12”

A. All pipe and fittings intended for conveying or transmitting wastewater or reclaimed water shall be designed for a minimum working pressure of 150 psi.

B. Polyvinyl chloride pressure pipe shall conform to AWWA Standards Specifications C900 latest revision, or C909, latest revision and ASTM D1784 and D2241, latest revision. PVC pressure pipe shall be made from Class 12454-A or Class 12454-B material and conform to the outside diameter of cast iron pipe with a minimum wall thickness of DR18.

C. Polyvinyl chloride pressure pipe less than 4” diameter shall be DR-21, PR-200.

D. Polyvinyl chloride pipe shall be purchased per Approved Manufacturer’s Product List.

E. The pipe used for wastewater shall be green in color. The pipe used for reclaimed water shall be purple in color.

7.04 PIPE MATERIALS FOR SIZES 14” THROUGH 36”

A. All pipe and fittings intended for conveying or transmitting wastewater or reclaimed water shall be designed for a minimum working pressure of 150 psi.

B. Polyvinyl chloride pressure pipe shall conform to the latest AWWA Standards Specifications C905-97 and ASTM D1784, latest revisions. PVC pressure pipe shall be made from Class 12454-A
or Class 12454B material and conform to the outside diameter of cast iron pipe with a minimum wall thickness of DR18.

C. Polyvinyl chloride pipe shall be purchased per the Approved Manufacturer’s Product List.

D. The pipe used for wastewater shall be green in color. The pipe used for reclaimed water shall be purple in color.

7.05 JOINTS

A. Joints for PVC pressure pipe shall be bell and spigot push-on rubber gasket type only. No solvent weld or threaded joints will be permitted.

B. The Engineer of Record or IRCDUS may consider other type joints for specific installation upon submission of specifications and approval.

C. Restraint joints, when required, see Approved Manufacturer’s Product List.

7.06 FITTINGS

A. All underground fittings shall be either ductile iron push-on, restrained, or mechanical joint. Mechanical joints shall conform to AWWA Standard Specifications C110/A21.10 or C153/A21.53 latest revisions. Fittings shall be fusion-bonded ceramic epoxy lined. The epoxy material shall be applied in one coat with a minimum dry film thickness of 40.0 mils and shall be Protecto 401 or approved equal. All aboveground exposed fittings shall be flanged.

B. The pressure rating shall be 350 psi.

C. Joint restraint, when required; see Approved Manufacturer’s Product List.

7.07 SUBMITTALS

Before starting fabrication of the PVC pipe and fittings, the Contractor shall submit complete detailed working drawings for approval by the Engineer and IRCDUS. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. Where special fittings are required, they shall be shown in large detail with all necessary dimensions. The drawings submitted shall show flanged jointed sections placed so as to be removable without disturbance to the main pipe sections.
7.08 MARKING

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Detail M-16 for specifications regarding installation.

B. Trace wire is required over all pipes.

C. A 2” wide magnetic I.D. location tape is required over all pipes. Tape is to be installed 12” below finished grade.

7.09 INSTALLATION

A. Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturer’s instructions. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment at no additional cost to the Owner. All piping shall be placed in a dry trench, unless the Engineer of Record and IRCDUS approve wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to Engineer of Record or his representative and IRCDUS. Engineer of Record or IRCDUS reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no cost to the Owner.

END OF SECTION
SECTION 8

SUBMERSIBLE WASTEWATER PUMPING STATION
SECTION 8
SUBMERSIBLE WASTEWATER PUMPING STATION

8.01 GENERAL

A. The station shall be complete with pumps, motors, piping, valves, electrical work (including motor controls), structure, connections and all other needed appurtenances, tested and ready for service prior to the sign-off or acceptance by IRCDUS.

B. These specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these specifications or not.

C. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in these specifications or not, and as required for an installation incorporating the highest standard for the type of service, including field testing of the entire installation and instructing the IRCDUS’s regular operating personnel in the care, operation and maintenance of all equipment.

D. All private lift stations must provide a repair company name and emergency telephone number on the electrical panel in case of a malfunction to the station. If a name and number is not provided, the IRCDUS reserves the right to call a company of its choosing to make a service call and repair the malfunctioning station. All charges to repair said station shall be charged to the owner of the station.

E. A manhole shall be constructed within 20’ upstream of a lift station. There shall be only one pipe connection from this manhole to the lift station. The pipe between the lift station and manhole shall be SDR-26 or C-900 PVC pipe.

8.02 DESCRIPTION OF SYSTEMS

The pump station shall be comprised of a concrete wet well, concrete valve pit, RTU, at least two submersible wastewater pumps and controls, discharge piping and all appurtenances as specified herein or needed. The pump station will pump raw, unscreened, domestic wastewater into a force main.
8.03 QUALIFICATION

A. To assure unity of responsibility, the motors and control system shall be furnished and coordinated by the pump manufacturer. The Engineer of Record shall assume responsibility for the satisfactory installation and operation of the entire pumping system, including pumps, motors, and controls as specified.

B. The pumps covered by these specifications are intended to be standard pumping equipment of proven ability as manufactured by a reputable manufacturer having extensive experience in the production of such pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.

C. The control system shall have an established record of successful performance for similar service and be approved by the IRCDUS.

D. All equipment furnished under this specification shall be new, and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.

E. The pumps shall be furnished complete with controls and accessories required, and shall be as on the Approved Manufacturer’s Product List. Grinders pumps shall be permitted for pumps 10.0 HP or less, unless otherwise approved by IRCDUS’s Engineer. Three phase electrical power will be required for all pumping stations. 120/240 volt service will be required for pump stations up to 20hp. 277/480 volt service will be required for pump stations larger than 20hp.

8.04 OPERATING INSTRUCTIONS

A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified by the County.

B. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided for one (1) full day to instruct representatives of the Owner and the Engineer on proper operation and maintenance. If there are difficulties in operation of
the equipment due to the manufacturer’s design or fabrication, additional service shall be provided at no cost to the Owner.

8.05 TOOLS AND SPARE PARTS

A. Any special tools required shall be provided.

B. The manufacturer shall furnish a complete set of recommended spare parts necessary for the first three (3) years of operation of the pumping system, which shall include at least the following:

1. 1 – set of upper bearings
2. 1 – set of lower bearings
3. 1 – set of upper and lower shaft seals
4. 1 – relay and phase monitor for each type supplied with the pump control panel for each station
5. Gringer Pump Station (2 Complete Sets) Impeller and Bottom Plate is one set.
6. Solid Handling Pumps (1 Impeller)
7. 1 – TCU001 Programmed to the corresponding Frequency

C. Spare parts shall be properly bound and labeled for easy identification without opening the packaging, and suitably protected for long-term storage.

8.06 WARRANTY

A. The Contractor and the equipment manufacturers shall warrant all equipment supplied under this section for a period of one (1) year. Warranty period shall commence on final date when the IRCDUS accepts the project.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the IRCDUS.

C. The manufacturer’s warranty period shall run concurrently with the Contractor’s warranty period. No exception to the provision shall be allowed.

8.07 MATERIALS AND EQUIPMENT

A. The pumping units required under this section shall be complete, including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness, and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.
B. Each foundation plate for each pump shall be rigidly and accurately anchored into position. The same pump manufacturer shall furnish all necessary foundation bolts, plates, nuts, and washers for installation by the Contractor. Each foundation plate shall be ½” thick Type 316 stainless steel. Foundation bolts, nuts, washers, and spare parts shall be Type 316 stainless steel.

C. Stainless steel nameplates giving the name of the manufacturer, head, speed, and all other pertinent data shall be attached to each pump and motor.

8.08 PUMPS

A. General

1. The pumps shall be totally submersible centrifugal pumps with close-coupled motors designed to pump sewage. The design shall be such that the pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, or need for personnel to enter the pump well. Each pump shall be fitted with a 316 stainless steel lifting cable of adequate strength, and shall be five (5) feet longer than wet well depth to control panel to permit raising the pump for inspection and removal.

2. The impeller shall be constructed of nodular iron SP. The hydraulic design shall incorporate a single vane centrifugal impeller. The design shall permit low liquid velocities and gradual acceleration and change of flow direction of the pumped media. The impeller/casing design shall result in a passage free of surfaces to which solid or fibrous materials can adhere. The overall pump design shall combine high efficiency, low required NPSH, large ball passage and the ability to handle high solids concentrations efficiently. All other parts shall be of close grain gray iron construction, with all parts coming into contact with sewage protected by a coat of rubber-asphalt paint. All external bolts and nuts shall be of stainless steel. The impeller shall be of a centrifugal type, capable of passing 3-inch minimum diameter solids, fibrous material, and heavy sludge. If riser pipes are less than 3” in the wet well then the pumps must be grinder pumps.
3. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten-carbide or silicon carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. The pumped liquid shall be sealed from the oil reservoir by one face seal and sealed from the oil reservoir from the motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, shall not be considered equal to tandem seal specified and required.

4. A sliding guide bracket shall be an integral part of the pumping unit, and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump with stainless steel anchor bolts and so designed as to receive the pump connection without the need of any bolts or nuts. Sealing of the pumping units to the discharge connection shall be accomplished by a simple linear downward motion of the pump, with the entire weight of the pumping unit guided by 304 stainless steel guides which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the sump, and no rotary motion of the pump shall be required for sealing.

5. Pump motors shall be housed in an air-filled, watertight casing. Motors shall be a NEMA Design B with a 1.15 service factor. Insulation shall be moisture-resistant NEMA Class F with a maximum temperature rise of 90 degrees Celsius above ambient temperature (4 degrees Celsius). Motor characteristics are noted on the Drawings. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. Each motor shall incorporate an ambient temperature compensated overheat sensing device and a moisture sending device wired in series. The protective devices shall be wired into the pump controls in such a way that if either device operates, the pump will shut down. The devices shall be self-resetting. The cable shall be fixed to the pump using a watertight trumpet assembly. The pump shall be capable of running continuously in a totally dry condition under full load,
without damage, for extended periods. Before final acceptance, a field running test demonstrating this ability, with four (4) hours of continuous operation (water supplied by the contractor) under the above conditions, shall be performed for all pumps being supplied, if required by the IRCDUS. Pump motor cables shall be suitable for submersible pump applications and shall be properly sealed.

6. Motor windings shall be treated with a mildew preventative.

B. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine runaway speed of the unit due to backflow through the pump.

C. Performance Requirements

For Performance Requirements, refer to IRCDUS Standards, Pumping Station Data Table on Drawing No. S-15.

8.09 ACCESS FRAMES AND GUIDES

A. The pumping station shall be furnished with the necessary aluminum access frames, complete with hinged and hasp-equipped covers, stainless steel upper guide holder, power cable holder and level sensor cable holder. The frames shall be securely mounted above the pumps. Doors shall have safety locking handles in open position. Doors shall be of aluminum-checkered plate with stainless steel hinges and hardware. The access cover and frame shall be as sized on the Drawings.

B. Lower guide holders shall be integral with the discharge connection. Guide bars shall be of Schedule 40, 2" Welded 304 stainless steel pipe of the size indicated on the Drawings and of the length required by the pump manufacturer.

8.10 PUMP CONTROL SYSTEM MANUAL SYSTEM (NON-REMOTE TRANSMITTER UNIT) (SEE DETAIL DRAWINGS S-16)

A. General

1. A pump controller shall be provided for the wastewater pumping station. The controller shall respond to the liquid level sensor to automatically start and stop pumps to pace pump station influent flow, and shall be approved by IRCDUS.

2. The pump controller shall be the standard system of the manufacturer as modified for this application. The wet well
levels to be used in operation are as shown on Detail Drawings S-14 and S-15 of the IRCDUS Standards.

B. Operation Requirements

1. The control panels shall consist of a main circuit breaker and generator breaker with mechanical interlock, an emergency power receptacle, a motor circuit protector (MCP) and magnetic starter for each pump motor, and 20 ampere, 120 volt circuit breakers as required. MCP motor control panel shall meet all requirements of service entrance by properly bonding neutral or shall be UL service entrance rated. A low and high level alarm and pump shutoff shall be accomplished by float type, liquid level control system, with all components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the “lead” and “lag” pumps after each pumping cycle. A three position alternate switch labeled “test-off-auto” shall be provided to manually select which pump shall be the lead pump, when necessary, and also be able to test the alternator to see if it is still operational.

2. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps, and shall operate on a 24-volt circuit.

3. An unfused safety switch shall be installed between the meter and panel. This switch shall be in a NEMA 3X, UL rated, stainless steel waterproof enclosure, per Approved Manufacturer’s Product List. Amperage shall be at least equal to that of the main breaker.

C. Construction

1. The electrical control equipment shall be mounted within a modified NEMA 3X, UL rated, stainless steel, dead front enclosure. The enclosure shall be equipped with a door and may incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. All lines entering the enclosure shall be protected by diaphragm type seals at the source and shall be behind the dead front enclosure, entering from the side or bottom only. The
seals shall prevent moisture from entering the enclosure. Two cable connectors per Approved Manufacturer’s Product List shall be provided to terminate the motor cables in the control panel. The connectors shall be suitable for a 2” conduit with a neoprene bushing suitable for the motor cables supplied.

2. Components

a. All motor branch circuit breakers, motor starters, and control relays shall be of highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component. A non-corrosive material shall be utilized for wire connection locations within the box.

b. A thermal-magnetic air circuit breaker, per Approved Manufacturer’s Product List, shall be furnished for the main breaker. The manufacturer shall seal all circuit breakers after calibration to prevent tampering. An Motor Control Panel (MCP) shall be provided for each motor starter. Each MCP shall be adequately sized to meet the pump motor and station operating conditions.

c. An open frame, across-the-line, NEMA rated, magnetic motor starter, Class 8536, per Approved Manufacturer’s Product List, shall be furnished for each pump motor. Reduced voltage motor starters, Class 8606, per Approved Manufacturer’s Product List, are required for all 30 HP and larger motors. All motor starters shall be equipped to provide under-voltage release and overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Overload reset push buttons shall be located on the inside of the control compartment door.

d. An emergency power receptacle shall be installed in the side of the control panel and connected to the line side of the generator breaker. The receptacle; shall be per Approved Manufacturer’s Product List.
e. A ground fault indicator duplex utility receptacle providing 120 volt, 20 amp, 60 hertz, single phase current shall be mounted on the internal door.

f. The control panel shall include an adjustable time delay relay to prevent both pumps from starting simultaneously. Time delay relays shall be electronic type.

3. Operating Controls and Instruments

a. All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.

b. Pump mode selector switches shall be Hand-Off-Auto type to permit override of automatic level control and manual actuation of shutdown of either pump motor. Operation of pumps in manual mode shall bypass all safety shutdown circuits except pump motor overload shutdown. Switches shall be oil-tight, per Approved Manufacturer’s Product List, providing three (3) switch positions, each of which shall be clearly labeled according to function. Separate indicator lamps, which shall operate at 115 volts input, shall be provided mounted above H.O.A. selector switches. Lamps shall be easily replaceable from the front of control compartment door without removing switch modules from their mounted positions.

c. Indicator lamps shall be mounted in oil-tight modules, see Approved Manufacturer’s Product List. Lamp modules shall be equipped to operate at 115-volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.

d. A six (6) digit, non-reset elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in “hours” and “tenth of hours.” The elapsed time meters shall be per the Approved Manufacturer’s Product List.
8.10 PUMP CONTROL SYSTEM (REMOTE TRANSMITTER UNIT)

A. A Remote Telemetry Unit (RTU) shall be supplied with the pump control system. The RTU shall be capable of acquiring analog and discrete data for transmission to the Central Telemetry Unit (CTU); The RTU shall also be capable of receiving instructions from the CTU for the operation of the pumps. See Approved Manufacturer's Product List for the separate components. (See IRCDUS Standards, Detail Drawings S-16.)

8.11 SHOP PAINTING

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All pumps and motors shall be shop primed, with primer compatible with the field painting.

C. All nameplates shall be properly protected during painting.

D. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection, and shall be satisfactory to the Engineer up to the time of final acceptance test.

E. Control Panels shall be made of stainless steel.

8.12 FIELD PAINTING

A. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.

B. All nameplates shall be properly protected during painting.

8.13 LIFT STATION –GENERAL

A. The Lift Stations Wet Well shall conform to the following size:

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DIAMETER (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>6</td>
</tr>
<tr>
<td>11-15</td>
<td>8</td>
</tr>
<tr>
<td>16-20</td>
<td>10</td>
</tr>
<tr>
<td>21-25</td>
<td>12</td>
</tr>
</tbody>
</table>

Or as approved by IRCDUS’s Engineer.
8.14 LIFT STATION LINERS-GENERAL

A. A Concrete Protective Liner (CPL) shall be installed in the lift station/wet wells, repumped lift stations, receiving manholes, drop manholes, and manholes as required by IRCDUS’s Engineer.

B. After the lift station lining operation has been completed, the Contractor in the presence of the IRCDUS’s representative shall visually inspect the lift station. In addition, at the IRCDUS’s request, the Contractor shall be required within one year to visually inspect the lift stations that were lined. The Contractor shall redo any work that has become defective.

8.15 LIFT STATION LINERS-MATERIAL-HDPE

A. The Lift Station Liner shall be HDPE (high density polyethylene) with a minimum thickness of 2 mm. All HDPE liner sheets shall be extruded with a large number of anchoring studs, a minimum of 39/ft², manufactured during the extrusion process in one piece with the sheet so there is no welding and no mechanical finishing work to attach the studs to the sheet. The liner shall have a pull out of 112.5 lbs./anchoring stud.

B. Flat liner sheet, non anchored, used for overlapping joints, shall have a minimum thickness of 3mm. All joints shall be sealed by means of thermal welding performed certified welders.

C. The lining shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to a 1/4-inch settling crack, without damage to the lining. The liner shall be able to bridge any expansion cracks that may occur.

D. Lining shall be repairable at any time during the life of the structure.

E. A certified fabricator shall custom fit the liner to the form work in order to protect the concrete surfaces from sewer gases. The interior surfaces to be protected shall include the walls, ceiling, and pipe entries.

F. For all lined manholes the use of HDPE Grade rings shall be used in lieu of brick or precast grade rings. Grade rings shall meet HS-25 load rating. Butyl sealant shall be used between each ring to make a watertight joint. The first grade ring shall be welded to the liner to provide a gas tight seal.

C. Upon request, the manufacturer shall provide written certification that the liner used meets or exceeds the requirement of this specification.
D. Provide a five (5) year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the liner system, shall protect the structure for at least five (5) years from all leaks, and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

8.16 LIFT STATION LINERS-MATERIAL-FIBER GLASS

A. The lift station liner shall meet all requirements of ASTM Specifications D-3753 for glass fiber reinforced polyester manholes or lift stations. See Approved Manufacturer’s Product List

B. Fiberglass liners shall have a three-year warranty period.

END OF SECTION
SECTION 9

MISCELLANEOUS VALVES
AND
APPURTEYNANCES
SECTION 9
MISCELLANEOUS VALVES
AND APPURTENANCES

9.01 GENERAL

A. All of the types of valves and appurtenances shall be products of well-established reputable firms who are fully experienced and qualified in the manufacturing of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

C. All buried valves and appurtenances shall be mechanical joint. All aboveground/exposed valves and appurtenances shall be flanged.

D. Gate valves shall be used on water, sewer, and reuse mains.

E. Plug valves may be used in lift station valve vaults as approved by IRCDUS.

F. IRCDUS’s Engineer on a case-by-case basis may approve valves and appurtenances other than those specifically called out in this Section for use. Criteria for approval shall include the interchangeability of the valve or appurtenance, or its parts, with those brands specifically called out in these specifications.

G. All exposed valves and appurtenances shall be painted per the Approved Manufacturer’s Product List. Water mains shall be painted blue, force mains shall be painted green, and reuse mains shall be painted purple.

9.02 GATE VALVES (3-INCH AND LARGER)

A. All buried gate valves shall meet the requirements of AWWA Standard Specification C509-01, or latest revision. Valves shall be rated for 150-psi working pressure and a minimum 300-psi test pressure. Valves shall be ductile iron body, bronze-mounted, resilient seated, non-rising stem type fitted with “O-Ring” seals. All bolts to be used in valve bonnet are to be stainless steel. The operating nuts shall be Standard AWWA 2” square. All valves shall open counterclockwise. Stuffing boxes shall be the “O-Ring” type. Gate valves shall be mechanical joint, ANSI Standards 21.11, except where shown otherwise.
B. Where required, gate valves shall be provided with a box cast in the road and a box cover. Box cover opening shall be for valve stem and nut. The contractor shall provide valve wrenches and extension stems from the same manufacturer as the valve to actuate the valves. The floor box and cover shall be per the Approved Manufacturer’s Product List. (See Drawing M-5).

9.03 CHECK VALVES

A. Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA Standard Specifications C508-01, or latest revision. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, non-shock, non-slam, slow closing, and hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges or 125 pound ANSI B2.1 threaded fittings, depending upon location.

B. When there is no flow through the line, the disc shall hang lightly against its seat. When open, the disc shall swing clear of the waterway.

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

D. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight, as necessary.

E. Check valves for PVC pipe less than 3” in diameter shall be of PVC Type 1, Series BC, with union, socket, threaded, or flanged ends, as required. Check valves for PVC pipes greater the 3” shall be bronze. PVC ball check valves shall be per the Approved Manufacturer’s Product List.

9.04 PLUG VALVES

A. Plug valves shall be non-lubricated eccentric type with semi-steel bodies, resilient faced plugs, and stainless steel or nickel seats in the body. Port area shall be at least 80 percent of full pipe area for valves 20 inches and smaller. Port area shall be 70 percent for all valves 24 inches and larger. All valves 4 inches and larger shall be of the bolted design. All exposed nuts, bolts, springs, and washers shall be hot dipped galvanized, except exposed hardware for submerged valves shall be of stainless steel. Valve bodies shall be semi-steel with 125-pound ANSI Standard flanged ends for interior or aboveground service; mechanical joint for buried service and for use with threaded cast iron or ductile iron piping shall have screwed end connections. The plug shall be one piece and of sufficient design so as not to require a stiffening member opposite the face plug.
B. Plug valves 6 inches or greater in diameter shall be equipped with gear actuators, which shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. All gearing shall be enclosed, suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bearing bushings.

C. Three-way plug valves shall be non-lubricated gear operated. Valve bodies shall be semi-steel with 125-pound ANSI Standard flanges, and plugs shall be resilient faced. Three-way valves shall be 3-way, 3-port, 270-degree turn.

D. Plug valves and actuators shall be as per the Approved Manufacturer’s Product List.

9.05 AIR RELEASE VALVES

A. The air release valves shall be installed as shown on the Drawings. Valves shall be provided with a vacuum check to prevent air from reentering the line. Aboveground air release valves for wastewater shall be per the Approved Manufacturer’s Product List.

B. The fittings shall be threaded. Belowground air release valves for wastewater shall be as on the Approved Manufacturer’s Product List. Air release valves for water lines shall be as per the Approved Manufacturer’s Product List.

9.06 FIRE HYDRANTS

Fire hydrants shall be traffic type, 5¼” valve opening and manufactured per the Approved Manufacturer’s Product List. Fire hydrants shall comply with the current AWWA Standard Specification C502-94, or latest revision, for fire hydrants for water works service. Each hydrant shall have 6” mechanical joint ends with harnessing lugs (“dog ears”) and shall open by turning to the left (counterclockwise). Fire hydrant shall be of ample length for 18” clearance above centerline of roadway. It shall be provided with two 2¾” hose nozzles and one 4½” pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1½” point to flat). Fire hydrants shall be equipped with “O-Ring” packing. Fire hydrant shall be painted Federal Safety red.
9.07 BACKFLOW PREVENTERS

All backflow preventers shall be mounted aboveground, in non-traffic areas on the customer’s side of the meter. Aboveground piping shall be ductile iron. Brass or Copper pipe may be used for pipe 2” in diameter or smaller. Backflow preventers shall be of reduced pressure/double check type with two (2) independently operating check valves, and shall be designed to operate in a horizontal flow mode. An independent relief valve shall be located between the two check valves. Reduced pressure feature shall be included in all commercial applications. Preventers shall be University of Southern California (USC) approved as per the Approved Manufacturer’s Product List.

9.08 VALVE BOXES

A. All buried valves shall have cast iron two or three-piece valve boxes with cast iron covers. Valve boxes shall be provided with suitable heavy bonnets and extend to match finished grade surface as directed by the Engineer. The barrel shall be one or two-piece, screw type, having 5¼” shaft. Covers shall have “WATER” cast into the top for all water mains, “SEWER” cast into the top for all wastewater force mains and “REUSE” cast into the top for all reuse mains. All valves shall have actuating nuts extended to within 24 inches of the top of the valve box cover.

B. Valve boxes shall be provided with concrete base and valve nameplate, with suitable anchors for casting in concrete. Nameplate shall be 3” diameter bronze disk with engraved lettering 1/8” deep, as shown on the Drawings and manufactured per the Approved Manufacturer’s Product List.

C. Valve boxes shall be installed in a concrete pad, as specified in Drawing Detail M-5. IRCDUS may eliminate concrete pad in asphalt pavement.

9.09 CORPORATION STOPS

A. Corporation stops for connections to ductile iron or P.V.C. piping shall be all brass or bronze suitable for 150 psi operating pressure, shall be iron pipe or AWWA tapered thread design, shall be as per the Approved Manufacturer’s Product List, and shall be of sizes required and/or noted on the Drawings.

B. Saddles shall be stainless steel double strap with epoxy coated iron saddle as per the Approved Manufacturer’s Product List.
9.10 FLEXIBLE COUPLINGS

A. Flexible couplings shall be either the split type or the sleeve type.

1. Split type coupling shall be used with all interior piping and with exterior piping as noted. The couplings shall be mechanical type for radius groove piping. The couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for angular deflection and contraction and expansion.

2. Couplings shall consist of ductile iron, ASTM Specification A47, Grade 32510 housing clamps in two or more parts, a single chlorinated butyl composition sealing gasket with a “C” shaped cross-section and internal sealing lips projecting diagonally inward, and two or more oval track head type bolts with hexagonal heavy nuts conforming to ASTM Specification A183 and A194 to assemble the housing clamps. Bolts and nuts shall be stainless steel.

3. Sleeve type couplings shall be used with all buried piping. The couplings shall be of ductile iron and shall be per the Approved Manufacturer’s Product List. The coupling shall be provided with stainless steel bolts and nuts, unless indicated otherwise.

4. All couplings shall be furnished with the pipe stop removed.

5. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

6. Ductile iron followers and middle rings conform to ASTM A-536, Grade 65-45-12, NSF-61 fusion bonded powder epoxy coating, Testing per AWWA C-219 (ANSI A21-11), Rating 200 psi working pressure per AWWA C-219, Compounded gaskets conform to compression test ASTM D-395 Method A & B, approved for water application.

9.11 STEEL CASING PIPE

A. Steel casings shall conform to the requirements of ASTM Designation A139 Grade “B” and shall be coated inside and outside by a black bituminous coating, minimum 5 mils thick. The casing pipes shall have the minimum nominal diameter and wall thickness as indicated below.
B. Field and shop welds of the casing pipes shall conform to the American Welding Society Standard Specifications. Field welds shall be complete penetration, single-vee groove or single-bevel groove type joints.

9.12 TAPPING SLEEVES AND VALVES

A. Tapping sleeve and valves shall be stainless steel wraparound type or ductile iron on potable water mains. IRCDUS shall direct the contractor which type to be used. Tapping sleeve and valves shall be stainless steel wraparound type for wastewater force mains and reuse water mains per the Approved Manufacturer’s Product List.

9.13 RESTRAINED JOINTS

See Section 11.04 for Restrained Joints

END OF SECTION
SECTION 10

TESTING AND INSPECTION OF
WATER MAINS, RECLAIMED WATER FORCE MAINS, WASTEWATER FORCE MAINS, AND GRAVITY SEWERS
10.01 PRESSURE AND LEAKAGE TESTS OF UNDERGROUND PRESSURE PIPING

A. No hydrostatic testing will be permitted until as-built drawings have been submitted and approved by IRCDUS.

B. At the beginning of the test period, thoroughly clean all new pipelines by whatever means necessary, including flushing, to remove all dirt, stones, pieces of wood, other material that may have entered the pipeline during the construction period, and all dirty and/or discolored water from the pipelines. If after this cleaning, any obstructions remain, they shall be removed. All debris cleaned from the pipelines shall be removed from the job site. Hydrostatic pressure and leakage tests shall conform to AWWA Standard Specifications C-605-94, or latest edition, for PVC pipe, with the exception that Specifications C-600-99, or latest revision, for D.I.P, and AWWA Standard Specifications. The Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line. Engineer or designated representative shall be present during all testing, televising, and final inspections.

The pressure required for the field hydrostatic pressure test shall be 1.5 times the normal working pressure at the point of testing, and not less than 1.25 times the working pressure at the highest point along the test section, but not less than 150 psi for water mains and 100 psig for sewer force mains. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 1 inch in diameter, pipe riser and angle glove valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 2 hours. The cost of these items shall be included as part of testing.

C. The leakage test may be conducted concurrently with the hydrostatic pressure test and shall be of not less than 2 hours duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines that fail to meet tests shall be repaired and re-tested as necessary until satisfactory test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe-lines shall be tested in such sections as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage. Testing shall be in accordance with the applicable provisions as set forth in Section 13 of AWWA Standard Specification c-600-99, or latest revision. The allowable
rate of leakage shall be less than the number of gallons per hour determined by the following formula:

\[ L = \frac{ND \times (P)^{1/2}}{7400} \]

- \( L \) = allowable leakage in gallons per hour
- \( N \) = number of joints in the section tested
- \( D \) = nominal diameter of the pipe in inches
- \( P \) = average test pressure maintained during the leakage test in pounds per square inch gauge

D. The Contractor must submit his plan for testing to the Engineer for review at least five (5) working days before starting the test. The Contractor shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the Engineer. The Contractor shall repair any damage to the pipe coating. Lines shall be totally free and clean prior to final acceptance.

E. The Engineer or his representative must be present during testing.

F. If thrust blocks have been approved for use, thrust blocks shall not be backfilled until inspected by IRCDUS inspectors.

10.02 ADDITIONAL PRESSURE TESTING FOR POLYETHYLENE (PE) PIPES

A. At the beginning of the testing period, thoroughly clean all new pipelines by whatever means necessary, including flushing, to remove all dirt, stones, pieces of wood, other material that may have entered during the construction period, and any dirty or discolored water from the lines. If, after this cleaning, any obstructions remain, they shall be removed. All debris cleaned from the lines shall be removed from the job site.

B. All PE water mains shall be field-tested. The Contractor shall supply all labor, equipment, material, gauges, pumps, meters and incidentals required for testing. The Contractor shall pressure test each water main upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.

C. All water mains shall be tested to 150 percent of the operating design highest point along the test section by a recording type pressure gage and a copy of the readout shall be submitted to the Engineer upon completion of the design pressure of the pipe that is 100 psi. The test pressure shall be measured at the test. All testing shall be conducted in the presence of the Engineer or a designated representative.
D. Testing shall be conducted after backfilling has been completed and before placement of permanent surface.

E. Allowable amount of makeup water for expansion during the pressure test of the pipe shall conform to Plastic Pipe Institute (PPI) Handbook of Polyethylene Pipe; Inspection, Tests, and Safety Considerations, unless otherwise approved by the Engineer. The Operating Safety Considerations, Post Installation, Hydrostatic Testing, Monitored Make-up Water Test, Table III, is on Pages 24 and 25 of the Handbook.

F. In any test of pipe laid disclosed leakage or significant pressure drop greater than the allowed, the Contractor shall, at its own expense, locate and repair the cause of leakage and retest the line. The amount of leakage that may be permitted shall be in accordance with AWWA Standard Specifications.

G. All visible leaks are to be repaired regardless of the amount of leakage.

H. The Contractor must submit his plan for testing to the Engineer-of-Record and Utility Inspector for review at least ten (10) days before starting the test.

10.03 DISINFECTING POTABLE WATER PIPELINES

A. Before being placed in service, all potable water pipelines shall be disinfected in accordance with AWWA Standard Specifications C-651-99, or latest revision. The location of the chlorination and sampling points will be as shown on the drawings. The Contractor shall uncover and backfill taps for chlorination and sampling, as required.

B. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages in accordance with Table 10-1 through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solutions shall remain in the pipeline for no less than 24 hours.

C. The use of chlorine tablets is strictly prohibited.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. The Contractor’s lab shall then make bacteriological sampling and analysis of the replacement water in full accordance with AWWA Standard Specifications C-651, or latest revision. The Contractor will be required to re-chlorinate, if necessary. The line shall not be placed in service until all the requirements of the State and County Environmental Health Departments are met.

E. Special disinfecting procedures shall be used in connections to existing mains where the method outlined above is not practical.
F. The Contractor shall make all arrangements necessary with an independent commercial laboratory approved by the Department of Environmental Health for the collection and examination of samples of water from disinfected water mains. Note: The Contractor may not collect his own samples. These samples shall be examined for compliance with the Department of Environmental Health’s and Florida Department of Environmental Protection’s requirements. Sampling shall be made daily and continuously until two successive examinations are found satisfactory. Should one examination be found unsatisfactory, the line shall be flushed and disinfected again. PVC Certified copies of all laboratory analyses shall be provided to the IRCDUS. The cost at all sampling, flushing and disinfecting shall be included in the contract price. IRCDUS personnel shall operate all valves and be present to determine and control the volume of water used for flushing.

### TABLE 10 – 1

Chlorine Required to Produce a 25-mg/L Concentration in 100ft of Pipe by Diameter

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>100-percent Chlorine (pounds)</th>
<th>1-percent Chlorine Solution (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.013</td>
<td>0.16</td>
</tr>
<tr>
<td>6</td>
<td>0.030</td>
<td>0.36</td>
</tr>
<tr>
<td>8</td>
<td>0.054</td>
<td>0.65</td>
</tr>
<tr>
<td>10</td>
<td>0.085</td>
<td>1.02</td>
</tr>
<tr>
<td>12</td>
<td>0.120</td>
<td>1.44</td>
</tr>
<tr>
<td>16</td>
<td>0.217</td>
<td>2.60</td>
</tr>
</tbody>
</table>

For Pipes larger than 16-inches in diameter see AWWA Standard Specifications C-651-99

10.04 TESTING OF GRAVITY SEWERS

A. Leakage test by exfiltration and infiltration, as described below, shall be made on all pipes.

B. Exfiltration tests shall be made on all pipes after backfilling. All sewers shall be tested such that water is filled to the rim of the lowest manhole being tested within each section being tested, as directed by the IRCDUS. Mechanical plugs shall be used on the gravity sewer system in such a manner that the air can be released from the sewer while it is being filled with water. The test shall be continued for one hour and provisions shall be made for measuring the amount of water required to maintain the water at a constant level during this period. If test results are unsatisfactory, the Engineer and/or IRCDUS may direct that additional test be made on any section or the entire pipe.
C. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and joint remade. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant level in the sewer for one hour does not exceed 100 gallons per inch of diameter per day per mile of sewer and if all the leakage is not confined to a few joints, the workmanship shall be considered satisfactory. If the amount of leakage indicates defective joints or broken pipes, the Contractor shall correct them.

D. Pipe shall be tested for infiltration after the backfill has been placed. Infiltration tests shall be made under the supervision of the Engineer and IRCDUS. The length of line to be tested shall be as directed by the Engineer and/or IRCDUS. The allowable infiltration shall be 100 gallons per inch of diameter per day per mile of sewer.

E. Rate of infiltration shall be determined by means of V-notch weirs, pipe spigot or by plugs in the end of the pipe, to be provided and installed by the Contractor in an approved manner and at such times and locations as may be directed by the Engineer and/or IRCDUS.

F. In an inspection of the completed sewer or any part thereof shows any manholes, pipes or joints that allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired, as directed by the Engineer and/or IRCDUS.

G. Leakage between two adjacent manholes may be double the amount above stated, provided the average leakage for a total length of any size does not exceed the amount first stated and provided there are not gushing or spurting leaks.

H. All water used in testing and flushing shall be furnished at the Contractor’s expense. The minimum amount of water to be used is two (2) times the volume of the pipe.

I. The Contractor may use an air test in lieu of the exfiltration test as described above. If he elects to do this, he shall submit his proposed method to the Engineer and/or IRCDUS for approval.

J. If the results of the air test are unsatisfactory, as determined by the County, the Contractor shall be required to perform the exfiltration test as outlined above.

K. At the conclusion of the work, the Contractor shall thoroughly clean the entire inside of the pipe by flushing with water or other means to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this outlet cleaning, obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a heavy rain, the IRCDUS will examine the pipe for leaks. If defective pipes or joints are discovered at this time, the Contractor shall repair them at his expense.
L. Upon completion of the work, the sewer system or selected sections therein shall be subjected to a final test and inspection. All work in the system or sections therein being tested shall be complete, cleaned and ready for use. Tests shall be as specified herein and shall meet all requirements as to line, grade, clean lines, infiltration, exfiltration and workmanship.

M. Inspection of mains shall be by use of a self-contained television system and lamping upon satisfactory completion and acceptance of final road base material. The facilities shall be provided and operated by the Contractor as specified below:

The Contractor shall provide the IRCDUS with videotape recordings, on VHS format, of the interior of all main line gravity sewers and the interior of all sewer laterals. The tapes shall be contained in an approved cartridge-type container. The tapes shall be recorded by pulling a television camera through the line along the axis of the pipe. The television equipment shall consist of a self-contained camera and a monitoring unit connected by a coaxial cable. These recordings shall be done during the inspection of the mains. Monitors shall be available to the Engineer and Owner during these inspections. Monitors shall also be provided with a “Polaroid” type camera so that as may be requested by the Engineer, photographs shall be made of a particular portion of the main being viewed. The tapes shall be properly exposed and the camera shall be in proper focus so that good, clear recordings showing detail are produced. Tapes shall be identified by audio recordings noting the manhole numbers, distances to service lateral connections, direction of lateral connection and any leaks, cracks or pipe defects. Each cartridge shall be clearly marked as to the contents and number, with an index of all cartridges. Videotapes of the completed mains shall be delivered to IRCDUS. The Contractor shall provide any assistance required the IRCDUS or the Engineer of Record.

END OF SECTION
SECTION 11
GENERAL DESIGN DATA
SECTION 11

GENERAL DESIGN DATA

11.01 GRAVITY SEWERS

A. A manhole shall be constructed 20 feet upstream of the lift station. There shall be only one pipe connection from the manhole to the lift station. The pipe between the lift station and the manhole shall be SDR-26 or C-900 PVC pipe.

B. All sanitary sewers shall be constructed as required by the IRCDUS. Design to be done according to Recommended 10 State Standards for Wastewater Facilities, latest edition, and current regulatory agencies requirements.

C. Gravity sewers shall be designed for estimated peak flow at ultimate development, which shall be the product of a selected peaking factor and the projected or known average daily flow at ultimate system development.

D. Projections of average daily flow shall be made using a per capita sewage flow of 100 gallons per day and in accordance with Indian River County ordinances. Peak hour (design) flows shall be estimated using a peaking factor as outlined within Recommended 10 State Standards for Wastewater Facilities, latest edition.

E. All sewers shall be sized to provide ample capacity for peak design flows. The minimum allowable pipe size shall be 8-inch for collection lines and 6-inch for service laterals. Sewers shall be designed at slopes providing minimum velocities of 2 feet per second when flowing full or half-full, using a Manning’s Roughness Coefficient (n) of 0.013 for ductile iron pipe and 0.012 for polyvinyl chloride pipe. In general, the following minimum slopes shall be provided for sewer sizes 8-inch to 36-inch or approved by IRCDUS:

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>DIP n = 0.013</th>
<th>PVC n = 0.012</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0.40%</td>
<td>0.34%</td>
</tr>
<tr>
<td>10</td>
<td>0.28%</td>
<td>0.24%</td>
</tr>
<tr>
<td>12</td>
<td>0.22%</td>
<td>0.19%</td>
</tr>
<tr>
<td>15</td>
<td>0.15%</td>
<td>0.13%</td>
</tr>
<tr>
<td>18</td>
<td>0.12%</td>
<td>0.10%</td>
</tr>
<tr>
<td>21</td>
<td>0.10%</td>
<td>0.09%</td>
</tr>
<tr>
<td>24</td>
<td>0.08%</td>
<td>0.07%</td>
</tr>
</tbody>
</table>

F. Manholes shall be installed at the end of each line, at all changes in grade, size or alignment, at all junctions (excluding service laterals) and at distances no greater than 400 feet apart.

G. Sewer laterals shall not be connected directly into manholes unless approved by IRCDUS. IRCDUS will direct industrial wastewater into manholes on case-by-case basis.
H. Gravity sewers must be installed in front (under driveway/roadway pavement) of new buildings and/or under roadway pavement in dedicated Rights-of-Way, all accessible to maintenance equipment.

I. Gravity Mains shall be installed a minimum of 10 feet from any existing or proposed structure (walls, trees, transformer pads, etc.).

11.02 WASTEWATER PUMPING STATIONS

A. A Remote Telemetry Unit (RTU) shall be included in all pump stations that are to be dedicated to Indian River County.

B. Wastewater pumping stations shall be designed to peak ultimate development flow from all contributory areas, in accordance with the Indian River County Wastewater Master Plan. Design average daily flow and peak hour flow shall be as set forth in Section 11.01.

C. Design of private lift stations that may be dedicated to the County at a later date shall meet IRCDUS design standards and shall be approved by IRCDUS. Any private station that does not meet IRCDUS design standards will not be taken over by the IRCDUS. Owners of private stations shall sign a form acknowledging future upgrade requirements if Owner is to dedicate a private station to the IRCDUS at a later date.

D. At least 2 pumps shall be provided for stations handling flows of 700 gallons per minute (gpm) or less. A minimum of 3 pumps shall be provided in stations where peak design flow exceeds 700 gpm unless otherwise approved by IRCDUS. In all cases, standby-pumping capability shall be provided such that if any one pump is out of service, an alternate unit is available at equal or greater capacity.

E. The sewage pump system shall be capable of pumping the design peak flow at the maximum computed system total dynamic head. Maximum residual head within existing force mains shall be obtained and coordinated through IRCDUS.

F. Pumps shall be capable of passing spheres of at least 3-inches in diameter, and pump suction and discharge piping shall be at least 4-inches in diameter. Grinder pumps shall be used when riser pipes in wet well are less than 3-inches. Minimum valve (all types) size is 4-inches.

G. Wet wells shall be a minimum of 6-feet in diameter (ID). All wet wells shall be sized to provide a minimum pump cycle of 15 minutes. Pumps shall be designed to provide a minimum pump run time equal to half the cycle time. Additionally, wet wells shall provide sufficient space for installed equipment and required suction pipe submergence and spacing. The wet well floor shall have a minimum slope of one-to-one to the hopper bottom.

H. A separate valve vault shall be provided to house the gate valves, check valves and the emergency pump connection. The vault shall be of sufficient size to allow for installation, removal and maintenance of the valves. The top of the valve vault shall be a minimum of 12-inches above the high water level of the associated development. The wet well top elevation and the valve vault top
elevation shall be a minimum of 12-inches above the associated elevations shown on the FIRM (Flood Insurance Rate Map) or 12 inches above the 25-year – 24-hour storm event elevation, whichever is greater.

I. In IRCDUS maintained lift station, pumps shall be per the Approved Manufacturer's Product List. If a grinder pump is proposed, see Approved Manufacturer's Product List. Only grinder pumps under 10.0 hp are permitted unless approved by IRCDUS.

J. Lift Station Calculation Checklist (all assumptions shall be listed in calculations and in an orderly fashion):

1. Design flow
2. Downstream force main size & downstream head pressure (in psi or feet of water)
3. TDH of pumps shall exceed system head curve
4. Pump selection make, model, HP, Impeller
5. a. Wet well dimensions
   b. Operating cycle and draw down time
6. Buoyant computations Documentation:
   a. Buoyant force
   b. Downward force
   c. Safety factor
   d. Depth to water table
7. Designer name, date, design firm, Indian River County project number, project name, designer name of revisions

K. Only one influent gravity main is allowed into the lift station. The first upstream manhole from the lift station must be located within 20 feet +/- 1-foot of the lift station and as approved by IRCDUS.

L. The owner of a private lift station must have a maintenance agreement with a qualified firm (individual) to maintain the lift station. A label must be posted on the lift station stating the name and 24-hour phone number of the responsible firm before lift station may be placed into operation. A copy of a maintenance contract is to be submitted prior to issuance of the Utility Construction Permit. Maintenance contract must be renewed annually with copies of said contract submitted to IRCDUS. Owners of private lift stations shall submit a letter to IRCDUS acknowledging that the lift station is substandard to the County Standard lift station.

11.03 WATER DISTRIBUTION

A. All water mains shall be constructed in accordance with the Indian River County Water Master Plan, latest edition, or current AWWA Standard Specifications and current regulatory agencies requirements.

B. All distribution systems shall be properly looped, where feasible, and valved to provide maximum flexibility in providing service.
C. Design shall be based on an average daily consumption of 100-gallons per capita per day, a maximum day (MD) factor of 2.25 times average day and a peak hour factor of 4.5 times average day, per Indian River County Ordinance.

D. Distribution systems shall be sized to provide for 100 percent of the combined required fire flow and maximum day demand rate, while maintaining a 20-psi residual pressure in the distribution system.

E. All water mains shall be designed to provide a minimum pressure of 25-psi at ground level at all points in the distribution system under all conditions of flow (except as noted in D above).

F. Dead-end 4-inch water distribution system mains may be used to serve up to 10 ERU’s, but shall not exceed 300 linear feet and down stream of last Fire Hydrant Assembly.

G. Fire flow requirements shall be as outlined within the Insurance Service Office (ISO) Fire Flow Requirements.

H. The minimum size main in diameter serving fire hydrants shall not be less than 6-inches in diameter for residential (single family) areas and 8-inches in diameter for commercial areas and multifamily residential areas.

I. Maximum fire hydrant spacing shall not exceed 1000-feet in single-family residential areas and 600-feet in commercial areas and multiple-family residential areas. No fire hydrant shall be over 500-feet from a single-family residence, multifamily residence, or commercial building.

J. All public fire hydrants shall be painted Federal Safety Red. Private fire hydrants shall have the body painted red with a white painted bonnet.

K. All fire mains shall be equipped with a detector check valve assembly as shown in IRCDUS Standards Detail W-8.

L. A gate valve must be installed within 20-feet of all fire hydrants on the same water main as the fire hydrant.

M. It shall be demonstrated that the water distribution system can supply the required demand rate and fire flow prior to acceptance by IRCDUS, and an on-site fire flow test shall be conducted by the Indian River County Fire Department or EMS.

N. Service connections and fittings shall be located outside of pavement, concrete curb, and/or concrete sidewalk areas unless otherwise approved by the IRCDUS.

O. Water mains and services shall be installed in front easements or in dedicated Rights-of-Way (not under pavement) accessible to maintenance equipment.

11.04 EARTHWORK AND BACKFILL
A. Excavation for all utilities and/or house connections shall be adequately guarded with barricades and lights, so as to protect the public from hazard. Streets, sidewalks, driveways, curbs, parkways and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the IRCDUS and/or Public Works.

B. Foundation material used for pipe bedding, from a minimum 6-inch distance below the pipe invert to the bottom 12-inches above the top of the pipe, shall be bank run sand and gravel.

C. All gravity sewer installation procedures must be in accordance with pipe manufacturer’s recommendations. All gravity sewers and force mains shall be installed to have a minimum depth of 36-inches. Installation of gravity sewers shall be controlled by use of a laser to maintain proper grade. A maximum tolerance of ½” dip will be accepted in gravity sewer construction. A 2-inch wide magnetic I.D. tape shall be placed continuously in the trench over all pipes, 12-inches below grade.

1. Trench – Trench width shall be kept to a minimum necessary for installation of the pipe and shall comply with current OSHA requirements. The trench bottom shall be graded uniformly to match the slope of the pipe.

2. Backfill – Only good quality backfill, free of stones, hardpan materials, roots, rocks, broken cement or other debris that might be damaging to the pipe shall be used. Backfill shall be placed in the trench in uniform lifts of 12-inches.

3. Compaction – All fill must be compacted by hand tamping from under the pipe up to the center line. Backfill shall be compacted in lifts up to the surface to achieve a minimum compaction of 98% of maximum density in roadways, shoulders, and easements, in accordance with AASHTO Specifications T-180 and ASTM D-2167.

4. Dewatering – Construction shall be accomplished in a dry trench. Well pointing may be required as necessary. All water entering excavations or other parts of the work shall be contained, collected and pumped to suitable places for disposal, as permitted by local and state regulation.

5. Sheeting – Sheeting and shoring shall be installed as may be necessary for the protection of the work, preservation of adjacent property and structures and the safety of employees. Sheeting and backing shall be uniform to OSHA requirements.

D. Installation of force mains (sewer or reused water) shall be in accordance with latest AWWA Standard Specifications C-600 and the installation specifications for water lines in the Water Distribution Section, irrespective of the type of pipe selected. A 2-inch wide magnetic I.D. tape and tracer wire shall be placed continuously in the trench over all pipes per Detail M-14, 12-inches below grade.

1. Trench – Trench width shall be kept to a minimum necessary for pipe installation and shall comply with current OSHA requirements. The trench
bottom shall be graded and alignment shall be parallel with roadway, where possible.

2. Backfill – Only good quality backfill, free of stones, roots, rocks, broken cement or other material that might be damaging to the pipe shall be used. Backfill must be put in the trench in lifts.

3. Compaction – All pipe must be compacted by hand tamping to the centerline, under the pipe. Backfill shall be compacted in lifts up to the surface to achieve a minimum compaction of 98% of maximum density in roadways, shoulders, and easements in accordance with AASHTO Specifications T-180 and ASTM D-2167.

4. Dewatering – Construction shall be accomplished in a dry trench. Well pointing may be required, as necessary. All water entering excavations or other parts of the work shall be contained, collected and pumped to suitable places for disposal as permitted by the Local, State or Water Management District.

5. Sheeting – Sheeting and shoring shall be installed as may be necessary for the protection of the work, preservation of adjacent property and structures and the safety of employees. Sheeting and bracing shall be uniform to OSHA requirements.

E. Installation of water mains must be in accordance with latest AWWA Standard Specifications C- 600 Series, irrespective of the type of pipe selected. All installation procedures must also be in conformance with pipe manufacturer’s recommendations. Minimum depth of cover shall be 36-inches. A 2-inch wide magnetic I.D. tape shall be placed continuously in the trench over all pipes, 12-inches below grade. Trace wire shall be wrapped on all pipes, per Detail M-14, valves, fittings, and all appurtenances. Allowable deflection of the pipe joints and curvature of PVC pipe shall not exceed the manufacturer’s specifications.
suitable places for disposal as permitted by the Local, State or Water Management District.

5. Sheeting – Sheeting and shoring shall be installed as may be necessary for the protection of the work, preservation of adjacent property and structures and the safety of employees. Sheeting and bracing shall be uniform to OSHA requirements.

11.05 RESTRAINED JOINTS

A. Restrained joints shall be used on lines per the Table of the IRCDUS Standards Drawing M-3. Section of piping having restrained joints or those requiring restrained joints shall be constructed using pipe and fittings with restrained “Locked-type” joints and the joints shall be capable of holding against withdrawal for line pressures up to 150 pounds per square inch (psi). The pipe fittings shall be as shown for restrained push-on joints or restrained mechanical joints on Page 416 in Section VI, in the Handbook of Cast Iron Pipe, 4th Edition. In all cases, restrained joints must be used per Section C below, with thrust blocks, per contract drawings.

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

C. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Drawing and formula below are provided for the Contractor as a guideline.

Where:

\[ L = \frac{1.5PA(1-\cos X)}{fw} \]

L = Length of pipe on each side of fittings or change in direction

P = 150 psi, unless otherwise noted

A = Cross-sectional area in square inches based on outside diameter (O.D.) of pipe

X = Angle of bend or change in direction in degrees

f = Coefficient of friction = 0.4 (maximum)

W = W (earth) + W (pipe) + W (water in pipe) = (density of soil*) (depth of cover in feet) (O.D. in feet)

* Maximum 12-lbs/cubic ft above maximum water table elevation
and 60-lbs/cubic ft below maximum water table

D. Bolts and nuts for restrained joints shall be A-53 stainless steel, low alloy, high
   strength steel.

E. The Contractor shall also provide restrained joints in accordance with the above
   criteria wherever below ground fittings are on lines 12-inches in diameter or less.

11.06 HORIZONTAL SEPARATION

A. All water and/or sewer utilities shall be located a minimum horizontal separation
   equal to the depth of the pipe plus the diameter of the pipe from any permanent
   above ground structures (i.e., walls, trees, transformer pads, etc.).

B. A minimum 4-feet separation is required between water/sewer utilities and other
   underground utilities such as telephone, gas, cable, irrigation, etc.

C. All water and/or sewer utilities shall be located a minimum horizontal separation
   equal to 2 times the depth of the pipe plus the diameter of the pipe from the top
   of bank of any bodies of water (i.e., storm water ponds, canals, etc.).

D. All water mains shall be located a minimum horizontal separation of 3 ft. from
   storm sewer, stormwater force main or reclaimed water main.

E. All water mains shall be located a minimum horizontal separation of 3 ft., with 10
   ft. preferred, from vacuum sanitary sewer mains.

F. All water mains shall be located a minimum horizontal separation of 6 ft., with 10
   ft. preferred, from gravity or pressure sanitary sewer, sanitary sewer force main
   or reclaimed water main.

11.07 VERTICAL SEPARATION

A. Maintain 18” vertical clearance between any water/sewer utility and any other
   underground utilities such as telephone, gas, cable, irrigation, etc.

B. All water mains shall maintain a minimum 6” vertical clearance between storm
   sewer, vacuum sewer system and gravity sewer with 12” vertical clearance
   preferred. A 12” vertical clearance shall be maintained between all water mains
   and pressure sewer systems, stormwater force mains and reclaimed water
   mains.

END OF SECTION
SECTION 12

PROCEDURES FOR SUBMITTAL, PERMITTING, CONSTRUCTION, AND ACCEPTANCE OF PRIVATE DEVELOPMENT PROJECTS
SECTION 12
PROCEDURES FOR SUBMITTAL, PERMITTING, CONSTRUCTION, AND ACCEPTANCE OF PRIVATE DEVELOPMENT PROJECTS

12.01 SUBMITTAL

A. The applicant shall submit the following items for a project to be considered for a utility construction permit:

1. Completed Utility permit application, copy of Department of Environmental Protection (FDEP) permit applications if applicable, copy of Department of Transportation (FDOT) permit application, Indian River County Right-of-Way permit, legal description, and applicable fees. Prior to the issuance of utility permit, applicant shall provide proof of all fee payment (i.e. capacity charges, line extension fee, etc).

2. Three (3) sets of 24"x36" construction plans, signed and sealed by a Professional Engineer registered in the State of Florida shall be submitted with application. Plans shall include a plan view of the water and/or wastewater systems with all elevations and inverts, sewer profiles (gravity and force mains), all appropriate details, a drainage plan with all elevations and inverts, and water line profiles where the water main crosses other utilities and as requested by IRCDUS. Water lines shall be stationed on the plans. All existing and proposed rights-of-ways, easements, and property lines shall be shown. Also, an accurate location map is to be provided. The limits of proposed dedication of the system(s) to Indian River County shall be specified on the plans.

3. A complete engineer’s design report, signed and sealed by a Professional Engineer registered in the State of Florida, setting forth the basis of design, shall contain the following, as a minimum:

   a. Water distribution system:
      (1) Description of geographic area to be served.
      (2) Existing and predicted population of areas to be served.
      (3) The effect of the proposed water distribution system on existing or proposed water distribution facilities.
      (4) The estimated daily flow.
      (5) Fire flow calculations for all hydrants being fed by lines smaller than 8", or as required by IRCDUS.
      (6) Description of materials to be used.
      (7) A preliminary cost estimate.
      (8) Any other factors which would affect design and use of the water distribution system.

   b. Gravity sewer system:
      (1) Description of geographic area to be served.
(2) Existing and predicted population of areas to be served.
(3) The effect of the proposed gravity sewer collection system on existing and proposed gravity sewer collection systems or pumping stations and force mains. Pump stations shall be modeled, and all in-line pumping stations and force mains receiving these additional flows shall be considered.

c. The effect of the proposed gravity sewer collection system on the wastewater treatment plant receiving the flows.

(1) The estimated daily flow.
(2) Description of materials to be used.
(3) A preliminary cost estimate.
(4) Any other factors which would affect design and use of the sewage system.

d. Pumping station and force main system:

(1) Description of geographical area to be served.
(2) Existing and predicted population of area to be served.
(3) Calculations for projected flows, wet well sizing, pump sizing and selection, force main sizing, and buoyancy.
(4) The effect of the proposed pumping station and force main system on existing or proposed pumping station and force main systems or gravity sewer systems receiving these additional flows. Pump stations shall be hydraulically modeled, along with all in-line pumping stations and force mains.
(5) The effects of the proposed pumping station and force main systems on the wastewater treatment plant receiving these flows.
(6) Description of materials to be used.
(7) A preliminary cost estimate.
(8) Any other factor which would affect design and use of the pumping station and force main system.

4. A review fee, as set forth in the current rate schedule. This fee shall cover review of a water system, a sewer system, or both, if submitted at the same time.

5. One original signed and sealed Department of Environmental Protection permit application for IRCDUS records.

12.02 CONSTRUCTION PERMIT

A. Prior to permit issuance and scheduling of a pre-construction meeting, three (3) sets of construction plans and specifications shall be submitted, signed and sealed by a Professional Engineer registered in the State of Florida, to be approved, stamped, and signed by IRCDUS. One (1) set shall be retained for IRCDUS records, one (1) set shall be delivered to the IRCDUS inspector, and one (1) set shall be returned to the Engineer of Record.
B. The Utility Construction Permit shall be valid for a period of one year from the date of issuance. If construction has not commenced within this time, a new utility construction permit with fee shall be submitted.

C. Payment of fee shall not constitute automatic approval of original plans.

D. The utility construction permit does not constitute a permit for operation.

E. Construction shall not begin until a copy of the Indian River County and all State and local permits that are required have been received for any construction in the right-of-way.

12.03 CONSTRUCTION

A. The Engineer of Record shall have a pre-construction meeting with IRCDUS a minimum of five working days before beginning construction, whereupon construction plans shall be reviewed, and a minimum of three (3) sets of shop drawings shall be provided. One (1) set to Indian River County Utilities Department, one (1) set to the IRCDUS inspector and the remaining sets to the Engineer of Record. No appurtenances shall be installed until approved by IRCDUS.

B. The Contractor and Engineer of Record shall notify IRCDUS a minimum of 48 hours prior to beginning construction or performing any system tests.

C. The water distribution system shall be constructed, flushed, disinfected, and tested in accordance with FDEP and IRCDUS Specifications.

D. All equipment, materials, and workmanship shall meet or exceed all current Indian River County Water and Wastewater Utility Standards and shall be subject to the unconditional inspection and approval of IRCDUS.

E. The Engineer of Record shall have an on-site inspector (representative) who shall witness and document all materials used, installation procedures, problems encountered, and witness and certify all tests specified by the operation permit checklists. Daily construction reports shall be submitted monthly to IRCDUS, and no later than seven days after completion of the construction. Indian River County has unconditional rights to inspect the construction and materials at any time.

F. Where water outages will occur, a minimum of five (5) working days notice to IRCDUS and the public is required. The IRCDUS water plant operator shall be notified a minimum of five (5) working days prior to flushing of lines. A five (5) working days notice is required for access to private property.

G. The Property Owner, Developer, engineering firm, and Contractor shall hold Indian River County harmless in any suits, claims, and/or liabilities arising from subject construction.
H. All connections to the IRCDUS water system shall be made in the presence of IRCDUS inspectors. IRCDUS personnel for the purpose of flushing, testing, and putting the system on line shall operate all valves on the IRCDUS systems.

12.04 ACCEPTANCE

A. No system shall be cleared for use by IRCDUS until all requirements of the operation permit checklist have been satisfied and approved by IRCDUS. See Part IV of these Standards for the requirements for IRCDUS Utility Construction Check Lists for Potable Water Distribution System and Wastewater Collection/Distribution System.

END OF SECTION
SECTION 13
WATER AND SEWER TREATMENT PLANTS
13.01 GENERAL

This section sets forth the general requirements for design and installation of sewer and water treatment plants to be constructed within the County.

13.02 DESIGN STANDARDS

Required Reference: Facilities shall comply with the design and installation requirements as established by the Florida Department of Environmental Protection and additional specific requirements stated in these standards. The criteria set forth in the “Ten State Standards-Recommended Standards for Water Works”, latest edition, should be used as a design guide for water treatment facilities. The criteria set forth in the “Ten State Standards-Recommended Standards for Wastewater Facilities”, latest edition, shall be used as a design guide for sewage treatment facilities.

13.03 STANDARD REQUIREMENTS

A. Building and Structure Sites

1. Clearing – Clear and remove obstructions within building sites only as required to provide adequate workspace and/or accomplish the specified construction. The removal of trees or permanent structures within the specified construction areas shall be done only as approved or directed by the County. Should the removal of valuable trees or shrubs be required, this work shall be done in cooperation with the local communities, in which the work takes place, in order that they may be replanted, if so desired. At sites of new structures, remove only such trees and shrubs as are necessary to facilitate the work and protect trees to remain against damage during construction period.

2. Grubbing – Grubbing shall be performed where required, including, but not limited to, areas where fill will be placed, structures erected, or where other installation is required. It shall include the complete removal of all obstructions resting on or protruding through the surface of the existing ground to a depth of three feet below finished grade. Where excavation is done, all stumps, roots and deleterious material thereby exposed shall be removed to a depth of three feet minimum below the excavated surface.

3. Disposal of Cleared and Grubbed Material – All refuse from clearing and grubbing operations shall be disposed of either by burning or removal to a dump area approved by the County. Burning shall be done at locations, and at times as directed, in a manner that will avoid all hazards. Permit(s) shall be obtained from all applicable authorities for burning and burning shall be kept under constant attendance until the fires have burned out or have been extinguished. Burning operations shall be done in compliance with all applicable regulations.
4. Unsuitable Material – All muck or other unsuitable material within the limits of building sites, or other designated areas, shall be excavated and removed. Depth of removal shall be that required to reach an approved suitable material. Removal and subsequent backfilling shall be maintained within the limits of the designated construction area unless specifically approved otherwise by the County. Sheet shall be installed and left in place along the site boundary, where required, in order to preclude infringement on adjacent property and prevent damage by future de-mucking. The Contractor shall dispose of muck or other unsuitable material. The cost of disposal shall be borne by the contractor.

5. Fill – Suitable fill material shall be placed and compacted where muck or other unsuitable material has been removed and as required to elevate the site to finished grade. Fill material shall conform to U.S. Bureau of Public Roads, Classification A-3, and as approved by a testing laboratory and the Public Works Division. Fill shall be placed in successive layers of not more than 12 inches, loose measure, and suitably compacted to 95% minimum of maximum density, as determined by AASHTO Specifications T-180, unless higher percentage is necessary in specific locations. Side slopes shall not exceed 2.5 (horizontal) to 1 (vertical), unless specifically approved otherwise, and shall be protected from erosion by staggered solid grass sodding, or other approved method. An approved, Florida State Certified testing laboratory shall make density tests for determination of the specified compaction.

6. Grading – All building sites shall be properly graded, including all cutting and filling necessary for the construction. Finish building site elevations shall be as required to preclude flooding and shall receive prior approval from the County. Filling shall be accomplished, if necessary, to provide acceptable site elevations. Finish surface grades shall eliminate potholes, abrupt changes in grade and bring the ground to an even surface, and shall provide adequate drainage for the complete site, with special consideration for the following. The grade shall be sloped evenly to provide drainage away from the building walls in all directions at ¼ inch per foot minimum for at least 10 feet from the building walls. Drainage swales shall have a minimum flow-line grade of not less than 1/8 inch per foot. Rounding shall be provided at top and bottom of banks and at other breaks in grade.

7. Asphaltic Concrete Pavement – Driveways, parking locations and other vehicular traffic areas at building sites shall be paved with an asphaltic concrete surface course. The dimensions for said surfacing shall be in accordance with good engineering practice and suitable for the designated service. Roadbed stabilization shall be 6-inch minimum below the base course and shall have a minimum Florida Bearing Value of 50 pounds per square inch. Base course shall be limerock or soil-cement, placed to 6-inch minimum thickness. Prime coat shall be rapid curing cutback asphalt RC-70, applied at the rate.
of 0.10 gallon per square yard. Asphalitic Concrete Surface Course shall be 1-inch minimum thickness, Type II.

8. Concrete Walks – In order to provide an all-weather surface for foot-traffic ways, concrete walks shall be provided between points of frequent travel. Walks shall be minimum 4 feet wide by 4 inches thick, with concrete construction in accordance with the standards specified under Section 13.03.B.3. The base material shall be thoroughly compacted to 95% of maximum density per AASHTO Specification T-180. Walks shall be provided with expansion joints at structures and/or intervals not exceeding 18 feet, with dummy groove joints at 6-feet intervals. A broom finish shall be provided.

9. Fencing

a. General – All building sites shall be totally enclosed by protective fencing, unless specifically excluded from this requirement by the County. Said fence shall consist of 6-foot high chain link fabric. Fence shall be fabricated and installed in accordance with good standard practices and shall be complete, including top rail; stretcher bars and clips; all end, corner, pull and gate posts; post braces; ornamental post tops; and other necessary items. The fence shall include a minimal of one gate opening 12 feet in width, consisting of two 6-feet wide locking, 180 degree, swing gates, with total height equal to the fence (6 feet).

b. Materials – Fencing shall be fabricated in compliance with the following minimum material standards:

   Chain Link Fabric – 2” mesh woven from 9 gage steel wire.

   End, Corner and Pull posts – 2-½” Schedule 40 steel pipe.

   Gate Posts – 6” maximum width: 2-½” Schedule 40 steel pipe; and, 6’ to 12’ width; 3-½” Schedule 40 steel pipe.

   Gate Frames and Intermediate Posts – 1.875” outside diameter (O.D.), 2.71 pounds per foot (Lb./Ft.) steel tube.

   Post Braces and Top Rails – 1.625” O.D., 2.27 Lb./Ft. steel tube.

   Accessories – Steel.

   Coatings – Hot dip galvanized with 1.2 ounces of zinc per square foot, applied after weaving for fabric and following fabrication for all other ferrous metal items.

   Concrete – 2,500 pounds per square inch compressive strength.
c. Installation – The fencing shall be installed to proper grade, alignment and plumb, with corner posts and bracing provided at all angles in alignment. Posts shall be set 3 feet deep in concrete footings: 1'-4" diameter for line posts: and, 2'-0" diameter for gate and corner posts.

10. Landscaping and Grassing

a. General – Building sites shall be suitably landscaped in order to be harmonious with the existing or projected adjacent development, provide screening plants and, in general, present a pleasing appearance. Plants shall equal or exceed Standards for Florida No. 1, as given in “Grades and Standards for Nursery Plants,” Part I (1963) and Part II, State of Florida Department of Agriculture. The landscaper shall install the approved planting (grass, trees and shrubbery) in accordance with Indian River County Code Type A buffer and maintain said items until hardy growth has been established.

1 Landscaping – The Contractor shall provide the County with landscaping plans for approval prior to installation. Said plan shall be prepared by an experienced landscaping company and shall include only such plants which are established for the area of construction and which require minimal maintenance.

2 Grassing – The Contractor shall place solid sod, where not covered by structures or surfacing, over the total area of small facility sites (pumping stations, etc.) and over the prime area of large sites (Treatment Facilities), with additional placement, as required for erosion control. Where not solid-sodded, balance of the site area shall be totally grassed by plugging. Unless approved otherwise by the IRCDUS, the grass shall be Argentine Bahia. Sod and plugs shall be fresh and uninjured to time of installation, and sod shall be clean, have a well-matted root system, and have a minimum thickness of 2 inches.

b. Buildings and Structures

1. Excavation and Fill

Excavation shall not proceed until building lines have been surveyed and staked. The Contractor shall remove and dispose of all unwanted material, supply all fill material, and install all dewatering facilities, shoring and/or bracing needed.

Bearing capacity of surfaces in excavations or on compacted fill shall be adequate to support the building or structure to be placed thereon. County shall require testing by an independent testing laboratory to verify adequacy of the foundation design and/or to require special foundation
features, such as larger footings, piles, increased compactions, etc.

Fill and backfill shall be compacted to 95% of maximum density at optimum moisture, as determined by ASTM D-1557, Method D, or AASHTO Specification Method T-180.

Building site shall be kept clear of rubble and any material, which may be hazardous to persons or impede construction progress.

2. Soil Treatment – Termite Control

When structures are to be constructed of, or are to contain, any wood or wood products, soil treatment shall be required for termite control.

Chemicals shall be one of the following water-based emulsions, uniform in composition, containing a dye that will be readily seen to the naked eye after application to the soil, and containing in concentration by weight:

a. Dieldrin, 0.5 percent
b. Aldrin, 0.5 percent
c. Heptochlor, 0.5 percent
d. Or equal

Application of chemical selected shall be made to all areas along foundation walls, around piers and under all concrete slabs at the following rates:

a. Foundation walls and piers, all sides – 4 gallons per 10 linear feet, mixed with backfill, to a depth of (1) foot below finished grade for concrete; for masonry, increase application rate proportionately by depth of foundation or piers.
b. Within voids of masonry foundation walls or piers, apply to void at or near bottom of foundation at rate of 2 gallons for each 10 linear feet.
c. Under all concrete slabs less than 6 feet below finish grade – (1) gallon per 10 square feet.

3. Concrete Work

Design, material, workmanship and practices shall conform to American Concrete Institute Manual of Standard Practice (ACI 315) and the Code of Standard Practice of the Concrete Reinforcing Steel Institute (CRSI).

Field and laboratory tests shall be conducted by independent testing laboratory on structural concrete pours for buildings to ascertain that concrete design slumps and strengths are attained.
Applicable standards shall include latest editions of the following:

a. Southern Standard Building Code
b. Building Code Requirements for Reinforced Concrete – ACI 318
c. Concrete proportions and placing – ACI 211.1 and ACI 301
d. Concrete design for sanitary engineering structures – ACI Committee 350 Report 68-50
e. Formwork – ACI 347
f. Reinforcing bars – ASTM A-615, Grade 60
g. Stirrups and ties – ASTM A-615, Grade 40
h. Welded wire fabric – ASTM A-185
i. Cement for concrete not exposed to sewage – ASTM C-150, Type I
j. Cement for concrete exposed to sewage – ASTM C-150, Type II, or ASTM C-150, Type I, with sulfate resistant properties equal to Type II if Type II is not available and the design engineer affirms the acceptability of Type I
k. Watertight and chemical resistant concrete – ACI 614
l. Aggregate – ASTM C-33, salt free
m. Water – potable (free from oil, alkali, acid, salt, organic matter, etc.)
n. Ready-mix – ASTM C-94
o. Slump test – ASTM C-143
p. Compression Test – ASTM C-39, at cylinder ages of 7 days, 28 days and finally, if indicated and directed by design engineer, at extended time period, not to exceed 45 days
q. Test Cylinders-ASTM C-31 minimum of 3 per 50 c.y. of pour or fraction thereof.

Water stops and vapor barriers shall be provided as follows:

a. Water stops shall be installed at all construction joints in concrete structures retaining liquid and at all construction joints at or below ground level in concrete structures required to remain dry.
b. Damp check or waterproof membranes shall be installed under and around all concrete slabs to be placed against soil, with joints lapped a minimum of 6 inches.

4. Masonry Work

Concrete masonry units shall be of a modular design and conform to ASTM C-90, Grade U-1.
Brick masonry units shall be clay and conform to ASTM C-216, Grade SW for below groundwork and grade MW for the above groundwork.

Reinforcement of all masonry unit walls shall be provided at alternate courses with “Dur-O-Wall,” “Wal-lock,” “Block-Lok” or approved equal.

 Anchors and ties shall be of ferrous metal, with zinc coating conforming to ASTM A-153, Class B-1, B-2, or B-3, as appropriate, and as follows:

a. Rigid steel: 1” x ¼” x 24”, with ends turned down 3”.
b. Wire mesh: 16 gage, ½-inch mesh, 3” x 16”
c. Veneer ties: No 6 W & M gage wire bent 90 degrees to form 2-inch hook for mortar embedment, or 22 U.S. gage corrugated sheet metal.
d. Spacing of ties shall be such that each tie shall not support more than 3 square feet of wall area with vertical spacing not more than 24”, and with additional ties at wall openings.

Mortar shall conform to ASTM C-270 (except that slag cements shall not be used), Type M or S. Type N may be used for non-bearing interior walls and partitions above grade.

5. Waterproofing

Waterproofing shall be provided in two (2) coats on all exterior surfaces of subgrade concrete or masonry walls, with outside lap of vapor barriers, damp checks or waterproof membranes thoroughly sealed into the sidewall waterproofing material.

Waterproofing material shall be an asphalt base coating applied in accordance with manufacturer’s recommendations – Tnemec Co. No. 461, “Foundation Coating” (black) or approved equal.

Minimum film thickness (dry) after application shall be 8.0 mils for first coat, 6.0 mils for second coat.

6. Architecture and Wall Finishes

Complete architecture plans and specifications for building shall be submitted for approval by the County prior to construction. In no case shall a structure be planned or designed without regard to aesthetic appearance and maintenance costs.
Exterior wall finishes for permanent above-grade buildings or structures shall comply with one or more of the following selection of materials:

a. Stucco/stucco brick
b. Rubbed concrete
c. Brick, over masonry or sturdy wood frame
d. Stone aggregate on masonry
e. Stone
f. Asbestos-cement on masonry substrate

7. Metal Fabrications

Steel or other ferrous materials shall conform to the following:

a. Structural shapes and plates – ASTM A-36
b. Pipe – ASTM A-53
c. Bolts, machine – ASTM A-307
d. Bolts, high tensile – ASTM A-325
e. Galvanizing – ASTM A-123 or A-153, as applicable
g. Abrasive cast iron (nosings) – American Abrasive Metals Co. “Feralun,” or approved equal.
h. Cast steel – ASTM A-27, Grade N2
i. Stainless steel – Type 304, unless otherwise required or specified

Aluminum materials shall conform to the following:

a. Rolled shapes, smooth or checkered plates and extruded pipe – ALCOA 6061-T6 or approved equal
b. Other extruded shapes – ALCOA 6063-T5 or approved equal
c. Sheets – ALCOA 3003 or approved equal
d. Pipe hand railing – ASTM B-429

8. Windows

Natural light is preferred for all buildings, and use of common sizes, spaced for adequate natural lighting of interiors is encouraged.

Windows and frames shall conform to quality standards ANSI A-34 and AAMS 30 for high performance series.

Frames shall be basic aluminum 6063-T5 with fasteners of aluminum or stainless steel.

Plate glass shall be a minimum thickness of 7/32” and set in vinyl glazing material.
All windows shall be sealed all around, both sides, with a non-shrink silicone-base caulk.

9. Metal Doors and Frames

Door frames shall be a combination buck and frame type, with adjustable anchors for masonry applications. Frames shall be filled with sand-cement grout when installed.

Doors shall be constructed of honeycomb material with metal laminated facing. Minimum door thickness is 1 ¾”. Height is 6’–8”.

All doors and frames shall be mortised and reinforced to receive hardware. Non-ferrous metal should be used at all areas exposed to corrosive atmosphere.

All door frames shall be sealed all around, both sides, with a non-shrink silicone base caulk.

10. Finish Hardware

Hardware shall be heavy-duty type with non-magnetic accessories and compatible with door and frame materials.

Panic exit devices shall be provided in all areas of corrosive or hazardous atmosphere that may be encountered by occupants.

Finish hardware shall include:

a. Locksets – cylinder type with dead latch, suitable for master keying
b. Butt hinges – 1 ½ pairs per door, ball bearing type preferred
c. Door closers, holders and silencers
d. Thresholds – aluminum
e. Flush bolts
f. Panic exit devices, as indicated

11. Carpentry

All carpentry components shall be of high quality, with galvanized fasteners and treated wood where in contact with all masonry, metal or exposed to weather.

Rough Carpentry of construction grade lumber shall conform to standards as follows:

b. American Institute of Timber Construction - Uniform Specifications
c. Truss Plate Institute Specifications

Finish carpentry or millwork shall be of “B” or better yard grade seasoned lumber, conforming to applicable requirements of the Architectural Woodwork Institute. Shelving, cabinet doors, tops and ends shall be a minimum of ¾” plywood with all exposed edges trimmed with hardwood. Joints shall be tight and formed to conceal shrinkage.

12. Roofing

Moisture controls methods and materials for roofing shall be similar to Johns-Manville or Bird Specifications or approved equal for built-up and shingle roofs.

Flat roofs shall have a minimum slope of 1/16” per foot, with 5-ply built-up roofing meeting the requirements for a 20-year bond. All built-up roofs on concrete slabs or metal decking shall be applied to 1” rigid insulation board.

Pitched shingle roofs shall have a minimum pitch of 3-½" vertical to 12” horizontal, with seal-down type asphalt or fiberglass shingles at 300 lb. per square on two (2) layers of 15 lb. underlayment, meeting requirements for a minimum of 15 years’ warranty.

Fascia, gravel stops and soffits shall be of low maintenance materials, architectural metal or masonry preferred.

Flashing and trim shall be either galvanized steel, 24 gage minimum thickness, conforming to Fed. Spec. QQ-S775, Type I, Class C; or aluminum 0.019” minimum thickness.

Gutters and downspouts shall be provided on all permanent buildings. Screen protection from debris and concrete splash blocks are required for all downspouts. Materials shall be as follows:

a. Gutters – 24 gage galvanized steel or 0.032” anodized aluminum
b. Downspouts – 26 gage galvanized steel or 0.025” anodized aluminum
c. Hanger straps – same material as gutters, as 3’-0” on centers, with blocking behind downspouts

13. Specialties and Accessories

Stairs shall be of reinforced concrete or all-welded structural aluminum. Nosing and treads shall be non-skid. Tread widths and riser heights shall conform to applicable codes
wherever possible. The use of ship-ladders or vertical ladders is discouraged.

Handrails shall be of all-welded 1 ½” O.D. aluminum pipe, 42” high with intermediate rails. Rail post spacing shall not exceed 8’-0”. Kick plates shall be used on all areas above the first floor.

Grating and checkered plate shall be of aluminum (preferred) or galvanized steel, and designed to carry a uniform live load of 200 lbs. per sq. ft. with a safety factor of 5, based on ultimate strength. Reinforcing shall be utilized to preclude deflections greater than 1/160 of span. All grating and plates shall have non-skid surface(s).

Plumbing fixtures shall include, but not necessarily be limited to water closets and lavatories. IRCDUS may require shower, water heater and drinking fountain at larger facilities. Appropriate toilet partitions and stainless steel accessories shall be provided as indicated. Provide handicap facilities as required.

Fire extinguishers shall be 10 lb. Type ABC rechargeable units, provided and spaced as applicable in all buildings and structures.

Other safety equipment shall be provided wherever hazardous materials or equipment are utilizes, such as eyewash fountains, gas masks, emergency lighting, etc.

13.04 PAINTING

General

This section includes the general requirements for painting materials and workmanship, as applicable to all sewer and water facilities.

Painting materials shall be delivered to the work site in the original and unbroken containers, marked with the manufacturer name, type of material and analysis of the product, and stored at one location. Special care shall be exercised in the handling and maintenance of painting materials, and all applicable safety regulations shall be followed.

1. Painting System Schedule shall be included in the project specifications for specific facility items and surfaces. Said schedule shall include, but not be limited to, the specific surface to be coated and specified painting system, with minimum dry mil thickness per coat required.
a. Materials

All paints and painting materials shall be high-grade products of manufacturers of established reputation and shall be "Approved" for the intended use.

To ensure a satisfactory end product, it is essential that paint coats be mutually compatible; both shop and field applications. To this end, insofar as possible, all paints applied to a given surface shall be the product of a single manufacturer.

The paint material set forth in Subsection B.3.4, “Paint Schedule,” shall be the minimum acceptable type for the application indicated.

b. Application

The Builder shall do a complete painting job throughout the project in accordance with generally approved modern practice for work of high quality. Additionally, surface preparation and application shall be in strict compliance with the manufacturer’s recommendations, and paint shall not be extended or modified.

Factory finish coatings shall be inspected following installation and any mars or blemishes shall be touched up in the field with the original color and type of paint.

c. Painting Requirements

Table I, “Paint Schedule,” attached hereto, specifies in general the surfaces to be painted; service conditions for the indicated surfaces; finish paint coating for the specific surface and service condition; and other special requirements. The total painting system (surface treatment, primer, finish coat and other necessary applications) and minimum dry mil thickness per coat required to achieve the specified finish for the specific surface and service condition shall be in strict compliance with the paint manufacturer’s recommendations.

For convenience of description and as a standard for a quality comparative reference, the “Paint Schedule” indicates the finish coating by name, number, or both, for products manufactured by Tnemec Company, Inc. or an approved equal, for the subject manufacturer, and approved equal products are acceptable.

In addition to the data contained herein, painting for water storage tanks shall comply with AWWA Standard Specifications D102-97, or latest revision, “Coatings for Steel Water Storage Tanks.”
Unless specifically indicated under “Pipe Color Code”, the color for surfaces to be painted shall be as selected by the IRCDUS and in compliance with OSHA regulation. The finish paint color for exposed sewerage and water facilities piping shall be as follows for the specified service:

Pipe Color Code:

- Sewage—Gray (Solid)
- Sludge—Brown (Solid)
- Potable Water—Blue (Solid)
- Raw Water (water facilities)—Blue (with 2-inch bright orange bands spaced 24 inches apart)
- Reuse-Pantone Purple
- Brine-Orange
- Non-Potable Water (Plant)—(Bright Orange (Solid)
- Gas or Fuel Oil—Red (Solid)
- Compressed Air—Green (Solid)
- Chlorine Gas—Yellow (Solid)
- Chlorine or other chemical solutions—Yellow (with 24 inch red bands spaced 24 inches apart)
- Other Services—As directed by the County

Note: Banding shall be accomplished by painting or approved durable plastic adhesive tape.

Surfaces which shall not require painting (unless service color coding, or other specific coatings are required), are as follows: exterior piping, below ground; factory finished equipment; galvanized fencing; stainless steel; aluminum and brass; plastic or rubber; concrete floors and stair treads; interior of concrete below grade dry pits; and exterior concrete surfaces (as specifically approved).

### TABLE 1

**PAINT SCHEDULE**

<table>
<thead>
<tr>
<th>Surface to be Painted</th>
<th>Service Conditions</th>
<th>Finish Paint Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Application</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry &amp; Concrete (Walls &amp; Ceilings)</td>
<td>Interior Above Grade – Normal Conditions</td>
<td>Series 6 or 7</td>
</tr>
<tr>
<td>Masonry &amp; Concrete (Building &amp; Tanks)</td>
<td>Exterior Above Grade – Normal Conditions</td>
<td>Series 6 or Series 156/157</td>
</tr>
<tr>
<td>Wood Interior – Normal Conditions</td>
<td>Ponkote 300 Enamel</td>
<td>Primer Series 36-601</td>
</tr>
<tr>
<td></td>
<td>Exterior – Normal Conditions</td>
<td>Finish Series 23 or 23 HG</td>
</tr>
<tr>
<td>Metal (Machinery, Piping, Systems, etc.)</td>
<td>Interior – Normal Conditions – Nonsubmerged</td>
<td>Primer 50 – 330</td>
</tr>
<tr>
<td></td>
<td>Exterior – Normal Conditions – Nonsubmerged</td>
<td>Finish Interior Series 66</td>
</tr>
<tr>
<td>Metal (Machinery, Piping, Systems, etc.)</td>
<td>Severe Moisture &amp; Condensations Conditions</td>
<td>Primer Series 50-330</td>
</tr>
<tr>
<td></td>
<td>Nonsubmerged</td>
<td>Finish Series 73</td>
</tr>
<tr>
<td>Metal – Large Areas (Tank Surfaces, Structural Steel, etc.)</td>
<td>Exterior – Moderate to Normal Conditions – Nonsubmerged</td>
<td>Primer Series 66-1211 Interior Series 66 – Finish Series 73</td>
</tr>
</tbody>
</table>
Sewerage Facilities

<table>
<thead>
<tr>
<th>Material</th>
<th>Condition</th>
<th>Paint System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete (Wet Wells, Tanks, Channels, etc.)</td>
<td>Submerged or Severe Conditions ------ Color – Rigortex 3324 Enamel</td>
<td>Series 46-413 Coal Tar 104-------Series 104</td>
</tr>
<tr>
<td>Metal (Equipment, Piping Systems, Tanks, etc.)</td>
<td>Submerged, or Intermittently Submerged, or Extreme Conditions</td>
<td>Primer Series 661211—Finish 46-413 (2 coats, 8 mil. ea.)—46H (1 coat, 16 mil.)</td>
</tr>
<tr>
<td>Metal (moving Parts – Chains, Gates, etc.)</td>
<td>Submerged or Intermittently Submerged</td>
<td>Grease Coating</td>
</tr>
</tbody>
</table>

Water Facilities

<table>
<thead>
<tr>
<th>Material</th>
<th>Condition</th>
<th>Paint System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete (Tanks, Troughs, Basins, etc.)</td>
<td>Submerged, or Intermittently Submerged</td>
<td>Primer Series 20-1255, Beige 3-5 mil – Filler Series 63 – 1500, as applicable –Finish Series 20-BB82, 4-6 mils</td>
</tr>
<tr>
<td>Metal (Tanks, Piping Systems, Equipment)</td>
<td>Submerged, or Intermittently Submerged</td>
<td>Primer Series 20-1255, Beige 3-5 mil – Filler Series 63 – 1500, as applicable –Finish Series 20-BB82, 4-6 mils</td>
</tr>
</tbody>
</table>

Special Notes:

1. All galvanized or other nonferrous surfaces requiring painting shall be pretreated with an approved conditioner or passivator, as recommended by the paint manufacturer, prior to application of the painting system.

2. Bituminous coated pipe shall be coated with Inertol Tar Stop or approved equal, as recommended prior to application of the painting system.

3. Metal surfaces, in contact with concrete or masonry, shall be protected with Tnemec 46-413 Coal Tar coating or approved equal, as recommended. This provision shall not apply to concrete reinforcement, piping and fittings, or conduits and accessories.

13.05 ELECTRIC

A. General

The provisions of this Section, including other specific design considerations, shall be the minimum standards as applicable to all sewage and water facilities.

It shall be the responsibility of the Contractor to advise the appropriate electrical power company regarding the proposed facility prior to installation and to make the necessary provisions for service thereto.

In accordance with the provisions of the General Conditions, complete shop drawings and technical data shall be submitted to the IRCDUS including, but not limited to, motor control centers and control systems, with wiring diagrams and components; manufacturer’s data for switches, transformers, relays, lighting fixtures and other accessories; panel boards; and all other applicable information.

B. Materials, Equipment and Installation
General Requirements: Materials, equipment and workmanship shall conform to the applicable portions of the codes, specifications, standards and statutes listed below:

National Fire Protection Association:
NFPA No. 70 National Electrical Code

Local Codes:

At the place of the work, all applicable local codes, regulations and ordinances that are in effect will apply.

National Electrical Manufacturers Association:

AB 1  Circuit Breakers – Molded Case  
FB 1  Conduit Fittings, Cable Fittings and Accessories  
IC 1  Industrial Control  
SGB 1  Connectors – Electric Power  
KS 1  Enclosed Switches  
PB 1  Panel boards  
TR 1  Transformers  
SG 8.2  Connectors for Copper Conductors  
IC 4  Industrial Enclosures  
WC 5  Thermoplastic – Insulated Wire & Cable

American National Standards Institute:

C80.1  Rigid Steel Conduit  
C6.1  Terminal Markings for Electrical Apparatus

Underwriters’ Laboratories, Inc.

Standards for Cabinets and Boxes  
Standards for Service Equipment  
Standard for Industrial Control Equipment  
Standard for Thermoplastic-Insulated Wire

Illuminating Engineering Society:

IES Lighting Handbook

United States Federal Government:

Williams–Steiger Occupational Safety and Health Act of 1970 (OSHA)

Special Requirements:

Phase rotation of electrical service shall be: L1, L2, L3 (A, B, C) left to right when facing equipment.
Generator receptacles for portable emergency power connection shall be provided for all electrically operated facilities and shall be as described in the lit station portion of the standards.

Electrical Motors: Environment: Motors shall have enclosure types which provide safe protection from exposure to unusual environments such as chemical fumes, damp places, outdoors, poorly ventilated rooms or places with restricted air circulation. In general, enclosures shall be NEMA standardized motor types.

Insulation: Motor insulation materials shall be Class F Systems.

Size: Motors for non-submersible service shall be sized such that the nameplate horsepower rating shall not be less than 1.2 times the required shaft brake horsepower output. Appropriate NEMA design shall be used to provide torque and/or other load requirements.

Electrical Characteristics: Motor electrical rating shall be compatible with station electrical service.

Mounting: Motor Mounting shall be of standard NEMA design and shall be compatible with the driven apparatus.

Controls: Motors shall be controlled by NEMA standard controllers for all across the line or reduced voltage starting. Where variable speed pumping is required, the specifications or variable speed pumping is required, the specifications or variable speed control equipment shall be coordinated with the County. In general, motors shall be equipped with all necessary controls and devices for complete and operable systems.

END OF SECTION
SECTION 14

ENGINE DRIVEN GENERATOR SETS
SECTION 14
ENGINE DRIVEN GENERATOR SETS

PART 1-GENERAL

14.1.01 GENERAL

A. This specification defines the requirements for an emergency or standby Electric Generator Set. The generator set shall consist of an engine directly coupled to an electric generator, together with the necessary controls and accessories to provide electric power for the duration of any failure of the normal power supply.

Any and all local or state requirements for standby power systems not covered by this specification will be the responsibility of the Contractor, supplier and manufacturer to meet.

B. Housing developments of 200 or more units shall provide backup generator sets for emergency use as required. Generator shall be provided with automatic throw over switch that senses power interruption from the main power source, starts the generator and shifts the power supply to the lift station from the generator.

14.1.02 DESIGN STANDARDS

A. The equipment covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, U.L., IEEE and NEMA.

B. The Contractor shall provide a complete integrated emergency generator system. The system consists of a diesel generator set with related component accessories and Automatic Transfer Switch(es) as specified herein.

C. The generator set shall have the following characteristics:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>240/480 (As Required By Power Supply)</td>
</tr>
<tr>
<td>Phase</td>
<td>3</td>
</tr>
<tr>
<td>Connection</td>
<td>Y</td>
</tr>
<tr>
<td>Wire</td>
<td>4</td>
</tr>
<tr>
<td>Hertz</td>
<td>60</td>
</tr>
<tr>
<td>Power Factor</td>
<td>0.8</td>
</tr>
</tbody>
</table>

The generator set shall be capable of starting and running the existing loads and proposed loads without exceeding the maximum voltage and frequency variations specified herein, or the maximum temperature limitations of the engine and generator. The generator set shall be capable of starting all motor loads, with the non-inductive load applied first.
14.1.03 ACCEPTABLE MANUFACTURERS

A. Quality and Experience: All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment, as listed in the Approved Manufacturers’ Product List, Section 15. Units and components offered under these specifications shall be covered by the manufacturer’s standard warranty on new machines, a copy of which shall be included in the submittal.

B. There shall be one source responsibility for warranty, parts and service through a local representative with factory trained service personnel.

14.1.04 SUBMITTALS

A. Engine-generator submittals shall include the following information:
   1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
   2. Manufacturer’s catalog cut sheets of all auxiliary components such as Automatic Transfer Switches, battery charger, control panel, enclosure, main circuit breaker, etc.
   3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
   4. Weights of all equipment.
   5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
   6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, jacket water heater, remote alarm indications.
   7. The bidder shall submit with his submittal an estimate of engine mechanical data including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc. when operating at 100% load. These estimates shall be based on manufacturer’s data.
   8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
   9. Generator resistances, reactances, and time constants.
   10. Generator motor starting capability.
   11. Control panel schematics.
   12. Oil sampling analysis, laboratory location, and information.
   13. Manufacturer’s and dealer’s written warranty.

C. Operation and Maintenance Information. The system supplier shall furnish five sets of operating, maintenance and parts manuals covering all
components for the generator set system. The supplier shall also instruct the owner in operation and maintenance of the unit.

14.1.05 WARRANTY
A. The manufacturer’s standard warranty shall in no event be for a period of less than five (5) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Submittals received without written warranties as specified will be rejected in their entirety.

14.1.06 PARTS AND SERVICE QUALIFICATIONS
A. Engine driven generator sets which can be properly maintained and serviced without causing the County either to carry expensive parts stock or to be subjected to the inconvenience of long periods of interrupted service because of lack of available parts. The supplier shall specify the nearest location of permanent parts outlets from which parts may be obtained.
B. The engine-generator supplier shall have service facilities within 75 miles of the project site and maintain 24-hour parts and service capability. The distributor shall stock parts as needed to support the generator set package for this specific project.
C. The dealer shall maintain qualified, factory trained service personnel that can respond to an emergency call within 2 hours of notification, 24 hours per day.

PART 2 - PRODUCTS
14.2.01 GENERAL REQUIREMENTS
A. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Units and components offered under these specifications shall be covered by the manufacturer’s standard warranty on new machines, a copy of which shall be included in the submittal. Manufacturer shall be ISO9001 certified.
B. The system shall be free of injurious torsional and bending vibrations within a speed range from 10% below to 10% above synchronous speed.
C. The system shall be adequately guarded both physically and electrically for protection of operating personnel.

14.2.02 ENGINE
A. General Description. The engine shall be of the internal combustion type equipped to operate on natural gas, at locations where natural gas is available or No. 2 diesel fuel.
B. Engine Power Rating. The rated net horsepower of the engine at the
generator synchronous speed, with all accessories, shall not be less than that required to produce the KW required by paragraph 1.01. The horsepower rating shall take into account generator efficiency and all parasitic losses such as fan, battery charger, etc. The generator set shall be capable of producing the required KW (without overload) for the duration of the power outage (standby rating), under the following ambient conditions:

<table>
<thead>
<tr>
<th>Altitude, feet</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range, °F</td>
<td>0-100</td>
</tr>
<tr>
<td>Humidity at max. ambient temp. %</td>
<td>80</td>
</tr>
</tbody>
</table>

C. Fuel and Oil Consumption. Accompanying the supplier's bid, the bidder shall supply fuel and oil consumption estimates based on engine manufacturer's data, a copy of which shall be included in the submittal.

D. Governor (Engine Speed Control). The engine shall be equipped with a suitable governor to maintain frequency within limits, as specified below, by controlling engine and generator speed.

1. Type: isochronous
2. Stability: 1/4% maximum steady state frequency variation at any constant load from no load to full load.
3. Regulation: 1/4% maximum frequency deviation between no-load steady state and full-load steady state.
4. Transient: 5% maximum frequency dip on most severe motor starting condition. See paragraph 1.01.
5. Transient: 2 seconds maximum recovery time for maximum motor start.
6. The manual speed adjusting control shall be mechanical or electrical if located on the generator set or electrical if located in a remote control panel.

E. Engine Crank-Start System. The engine shall be electric start, provided with a solenoid energized motor, with either positive engagement or clutch drive to the engine.

1. Lead-calcium batteries shall be furnished to provide power to the engine cranking motor. The batteries shall be designed for operation at a minimum ambient temperature of 0 °F.
2. The voltage shall be as required by the engine manufacturer.
3. The batteries shall be capable of a minimum of four crank cycles (rolling) of the specified prime mover and have sufficient current available for "break-away" currents for the particular engine used at the specified worse case temperature.
4. A float type battery charger, compatible with the batteries selected, shall be furnished which shall maintain the starting batteries at full charge. The charging system shall permit charging from either the normal or the emergency power source. It shall have a high rate and low rate charging system. A voltmeter shall indicate the charge rate and the circuit will be protected by either fuses or circuit breakers. The charger or charging circuit shall be so designed that it will not be
damaged during the engine cranking, achieved, for example, by a current limiting charger or a crank disconnect relay. It shall also be capable of recharging a discharged battery in 12 hours while carrying normal loads.

F. Engine Cooling System. The engine shall be liquid cooled. The type of liquid cooling system shall be a unit mounted radiator. The radiator capacity shall be suitable for operation in the ambient temperature specified in paragraph 2.02, plus the air temperature rise across the engine.

G. Air Supply/Exhaust System.

1. Cleaner: An air cleaner and silencer shall be furnished as recommended by the engine manufacturer and shall be located and mounted as recommended by the engine manufacturer.

2. Exhaust: An exhaust system of suitable size, configuration and material in accordance with engine manufacturer's recommendations shall connect the exhaust outlet of the engine to the silencer. The type of silencer shall meet the requirements of engine manufacturers and shall be residential silencing type.
   a. The exhaust system and silencer shall have the configuration shown on the drawings, and shall be of such size that back pressure on the system will not exceed the back pressure permitted by the manufacturer's recommendation. A flexible connection shall be mounted at the engine exhaust outlet and the discharge end of the exhaust line shall be protected against entry of precipitation. Piping within reach of personnel shall be protected by screening or suitable lagging. All exhaust piping shall be gas tight.

H. Engine Protective Devices. The following engine protective devices shall be provided, and an indicating light shall be supplied for use with each device specified.

1. Alarm system for high water temperature and/or low oil pressure.

2. Automatic engine shutdown for high water temperature and/or low oil pressure.

3. Combination alarm and shutdown system for high water temperature and/or low oil pressure.

4. Engine overspeed automatic shutdown device.

5. Engine failed to start indicator light (overcrank).

6. Alarm for low coolant level.

7. A shunt trip and undervoltage trip shall be incorporated to cause the circuit breaker to open simultaneously with any automatic shutdown of the engine.

I. Fuel Supply for Engine.

1. Main Fuel Storage Tank:

   (Alternate external fuel tank) Main Fuel Storage Tank: A fuel storage tank with sufficient fuel capacity to allow the unit to operate
continuously for 10 days shall be located in the place indicated on
the plans and shall be complete with all piping and fittings
connected. The tank shall be new and unused, and no galvanized
material shall be used in the tank or system. The tank shall be
furnished with faucet valve located in the supply pipe of the tank and
a check valve incorporated to ensure prime is maintained. The tank
shall be vented to atmosphere. Location and installation of the fuel
storage shall be in accordance with applicable government,
insurance restrictions, and local building code. A fuel level gauge
shall be located at the tank.)

2. Main Fuel Delivery System: A system shall be supplied to deliver an
adequate amount of fuel to the engine from the storage tank. Pipe
sizes shall be no smaller than the minimum recommended by the
engine manufacturer to avoid fuel flow restriction. The engine supply
and return line shall be equipped with a length of flexible fuel lines,
unions and gate valves. No copper lines are acceptable.

3. The system shall include an engine driven transfer pump of sufficient
lift and capacity to deliver fuel at the maximum required rate from the
storage tank to the engine. A check valve shall be furnished in
supply line at engine.

4. The tank shall be sized to allow full capacity generator operation for
a minimum of seventy-two hours without refilling.

14.2.03 GENERATOR

A. Description. The generator shall meet all requirements of NEMA MG-1, Part
22, in design, performance and factory test procedures. The regulator shall
be factory wired and tested with the generator. The generator shall have the
characteristics and ratings required by paragraph 22.10.

B. Excitation System. The generator shall be equipped with a permanent
magnet generator (PMG) excitation system. Both the PMG and the rotating
brushless exciter shall be mounted outboard of the bearing. The system
shall supply a minimum short circuit support current of 300% of the standby
rating for 10 seconds. The rotating exciter shall use a three phase full wave
rectifier assembly with hermetically sealed silicon diodes protected against
abnormal transient conditions by a multiplate selenium surge protector.

C. Construction. The insulation system of both the rotor and stator shall be of
NEMA Class H materials and shall be synthetic and non-hygrosopic. Field
windings shall be on the rotor, and the rotor core shall be shrunk-fit and
keyed to the shaft. The stator winding shall be of 2/3 pitch design to
eliminate the third harmonic. Units rated above 1500 kW or 601 volts or
higher shall be form wound.

1. The temperature rise of both the rotor and the stator shall be in
accordance with the applicable sections of NEMA MG-1-22, BS-
5000 part 99, or CSA C22.2, for the type of service intended. The
generator shall be self-ventilated.
D. Conduit Box. Load connections shall be made in the front-end mounted junction box. The generator construction will allow connection to the load through the top, bottom or either side of the junction box.

1. The conduit box shall contain two compartments: one to house the rotating rectifier and PMG, and the other to house the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments.

E. Verification of Performance. All performance and temperature rise data submitted by the bidder shall be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of full load, 0.8 power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

F. Efficiency. The generator efficiency shall be determined in accordance with NEMA MG-1, paragraph 22.44. All test results shall be submitted to the Engineer for approval.

14.2.04 VOLTAGE REGULATION

A. The generator shall be equipped with a voltage regulator to maintain voltage within limits as specified below:

1. Stability: 1/2% maximum voltage variation at any constant load from no load to full load.
2. Regulation: 1% maximum voltage between no load steady state and full load steady state.
3. Transient: 20% maximum voltage dip in most severe motor starting condition. See paragraph 1.01.
4. Transient: 2 seconds maximum voltage recovery time with application or removal of 0.8 P.F. full load.

B. The regulator shall be a solid state type using transistors or SCR's. The unit shall include volts/hertz underspeed protection, 3 phase RMS sensing, and overexcitation protection. The regulator shall also provide loss of sensing protection, regulator current limit, temperature protection and an engine unloading circuit. EMI suppression shall be provided meeting MIL-STD-461B, part 9 standards.

14.2.05 GENERATOR FULL MAIN LINE CIRCUIT BREAKER

A. A generator main circuit breaker shall be provided rated at manufacturers recommended amperes minimum frame size, and volts, 100% rated. The interrupting capability shall be greater than the generator short circuit capability, but not less than 60,000/30,000 symmetrical amperes at 240/480 volts. The breaker continuous current trip rating shall be selected to provide overload protection for the generator.

B. The breaker shall be provided with a shunt trip device. The generator starting circuit battery system will be used as the power source for the shunt
trip circuit. The shunt trip coil voltage shall be suitable for use on the starting circuit.

C. The breaker shall include 3 normally open and 3 normally closed auxiliary contacts.

D. The breaker shall be a NEMA 4X.

14.2.06 AUTOMATIC START AND STOP CONTROLS

A. General Description. Automatic starting and stopping controls shall be furnished to start the engine automatically when the normal electric power fails or falls below specific limits and to stop the engine automatically after the normal power supply resumes. The signal for starting or stopping the engine shall be from an external auxiliary contact. The controls shall be capable of operating at 50% of normal DC system supplied voltage.

B. Engine Cranking Control. Crank control and time delay relays shall provide at least one cranking period. If only one cranking period is provided, its duration shall be at least 15 seconds. If more than one cranking attempt is provided, each cranking period shall be for at least 7 seconds, and the cranking attempts shall be separated by appropriate rest periods. A sensing device shall automatically disconnect the starting circuit when the engine has started. If the engine has not started at completion of the starting program, the overcranking signal shall so indicate. The engine starting controls shall be locked out and no further starting attempts shall take place until the overcranking device has been manually reset.

C. Selector Switch. A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine, a "manual" or "handcrank" position that permits the engine to be started manually by the pushbutton on the control cabinet and run unloaded; an "automatic" position which readies the system for automatic start or stop on demand of the automatic load transfer switch or a programmed exerciser.

D. Manual Test Operation. It shall be possible to start the engine manually and run it unloaded by a manual pushbutton on the control cabinet that causes the engine to start, run and stop through the automatic start and stop controls.

14.2.07 INSTRUMENTATION

A. Instruments and Controls. The following engine and generator instruments and controls shall be furnished and installed:

1. A.C. ammeter
2. A.C. voltmeter
3. Governor speed adjusting control
4. Water temperature gauge
5. Oil Pressure gauge
6. Manual start/stop control
7. Voltmeter/ammeter phase selector switch
8. Elapsed time meter
9. Panel lights
10. Indicator lights for engine alarm

All wiring and interconnections shall be in accordance with commercial electrical standards.

B. Location

1. All of the foregoing instruments, lights and controls shall be mounted in a control panel on the generator set. All instrumentation must be isolated from engine generator set vibration.

2. In addition, an ammeter, voltmeter, "generator ready" light, a start/stop control, and an audible alarm and alarm light shall be provided in a generator control panel to be remotely wall mounted. The audible alarm and alarm light shall operate for any of the engine or generator alarms provided on the local control panel. Cable between the local and remote control panels shall be provided.

C. Panel Design. All instruments, controls and indicating lights shall be properly identified. All wires shall be individually identified and must agree with wiring diagrams provided.

D. Terminals on all terminal blocks shall be individually identified.

14.2.08 ACCESSORIES

A. Enclosure. The entire engine-generator assembly, including the battery, battery charger, day tank, lift pump, control panel, and radiator shall be enclosed in a steel or aluminum sound attenuated enclosure suitable for an outdoor environment. The enclosure shall attenuate to a decibel level of 65-70 dB at a distance of 7 meters horizontally in any direction around the entire generator enclosure. The enclosure shall be rated NEMA 3R, and shall be of adequate strength to withstand a 90 MPH wind without damage. Provisions shall be made on the enclosure for mounting the engine exhaust silencer. Louvers or dampers shall be provided to allow adequate radiator ventilation during operation without reducing the rating of the engine-generator unit. Doors shall be provided as required for access to the engine and control panel. Generator pad / platform shall have a maintenance walk a minimum of 3’-0” wide around three sides of the generator, also see plans. Stairs shall be provided from grade to the pad / platform where the elevation difference is greater than 1’ – 0” from final grade to the top of the generator pad / platform.

B. Block Heater. An engine block heater shall be provided to keep the engine coolant at a temperature of 85° F with the ambient temperature at the minimum specified in paragraph 2.02. The heater shall be suitable for operation at 120/240 (NOTE TO DESIGNER Select desired voltage) volts ac, single phase.
C. Control Panel Heater. A heater shall be provided in the control panel to keep the interior of the panel above 40° F when at the minimum ambient temperature specified in paragraph 2.02. The heater shall be operated by a thermostat, and shall be suitable for operation at 120 volts ac, single phase.

14.2.09 TRANSFER SWITCH

A. Automatic Transfer Switches required with a stainless steel 4X breaker disconnect cabinet, as approved by IRCDUS Engineer.

14.2.10 TELEMETRY

A. Telemetry equipment required, as approved by IRCDUS Engineer.

PART 3 – EXECUTION

14.3.01 INSTALLATION

A. Install equipment in accordance with manufacturer’s recommendations, the project drawings and specifications, and all applicable codes. Installation of the system includes but is not limited to pouring a concrete pad for the generator set and automatic transfer switch, receiving and offloading the equipment, providing all labor, permits and material to install the total system.

B. Mounting. The mounting of the generator set shall be sufficiently rigid to maintain alignment and to minimize the engine and generator stresses. The floor loading shall not exceed 5000 lbs. per sq. ft. A suitable number of spring type, vibration, rubber type, and fiberglass isolators shall be inserted between the engine generator set and the floor.

14.3.02 START-UP AND TESTING

A. Acceptance Test. A complete system load test shall be performed after all equipment is installed. The extent of testing shall be at the discretion of the engineer. The completed generator set shall be tested at 1.0 P.F. for a period of one hour at full load prior to shipment to the job site. In addition, the generator set supplier shall include in his bid the cost of an on site, full load test (using portable resistive type load banks or building load or combination thereof) for a minimum of four hours in the presence of a representative of the owner and/or engineer before final acceptance.

B. Coordinate all start-up and testing activities with the Engineer and Owner.

C. After installation is complete and normal power is available, the manufacturer’s local dealer shall perform the following:

1. Verify that the equipment is installed properly.
2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.
3. Test all alarms and safety shutdown devices for proper operation and annunciation.

4. Check all fluid levels.

5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.

6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.

7. Connect the generator to building load and verify that the generator will start and run all designated loads in the plant.

D. Perform a 4 hour load bank test at full nameplate load using a load bank and cables supplied by the local generator dealer. Observe and record the following data at 15 minute intervals:

1. Service meter hours
2. Volts AC - All phases
3. Amps AC - All phases
4. Frequency
5. Power factor or Vars
6. Jacket water temperature
7. Oil Pressure
8. Fuel pressure
9. Ambient temperature

C. Operation and Maintenance Manuals

1. Provide five (5) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams, start-up test reports, and recommended preventative maintenance schedules.

2. Ventilation Requirements. The bidder shall submit with his submittal an estimate of air flow requirements for cooling and combustion, plus an estimate of heat rejection of the engine and generator when operating at 100% load. These estimates shall be based on manufacturer's data.

D. Training

1. Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

E. The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing.

**END OF SECTION**
SECTION 15

APPROVED MANUFACTURER’S PRODUCTS LIST
AIR RELEASE VALVES (SEWER)
   1. ARI

AIR RELEASE VALVES (WATER)
   1. ARI
   2. GA INDUSTRIES
   3. VALMATIC
   4. APCO

BACKFLOW PREVENTER (RPZ) AND DOUBLE DETECTOR CHECK
   1. AMES SILVER BULLET
   2. FEBCO
   3. WILKENS
   4. WATTS

BLOW-OFF VALVES
   1. JOHN C. KUPFERLE FOUNDY CO. MODEL ECLIPSE NO. 85
      OR APPROVED EQUAL

BRONZE GATE VALVES
   1. AMERICAN
   2. RED-WHITE
   3. NIBCO
   4. UNITED

CASING SPACERS/ INSULATORS
   1. APS- ADVANCE PRODUCTS SYSTEMS
   2. CASCADE WATERWORKS MFG.
   3. RACI
   4. PSI- PIPELINE SEAL AND INSULATOR

CHECK VALVES- WEIGHT & LEVER- RESILENT SEAT
   1. AMERICAN DARLING
   2. CLOW
   3. M&H/KENNEDY
   4. MUELLER
   5. VALMATIC

CORPORATION STOPS
   1. FORD: FB1100G, FB1700
   2. MUELLER: H-15028 & H10046
   3. MCDONALD

COUPLINGS
   1. HYMAX
2. SMITH-BLAIR
3. DRESSER
4. EBG-IRON

CURB STOPS
1. FORD: KV43-342WG, KV43444WG, BA43342WG, BA43444WG, B41666WG, B41777WG, BFA43-666WG * & BFA43777WG
2. MUELLER: (EQUAL FORD PART NUMBERS)
3. MCDONALD: (EQUAL TO FORD PART NUMBERS)

DUCTILE IRON PIPE
WATER: CEMENT LINED CLASS 350/50
SEWER/FORCEMAIN: PROTECTO 401 LINED CLASS 350/50
1. AMERICAN
2. CLOW
3. MCWANE
4. US PIPE
5. GRIFFIN

DUCTILE IRON FITTINGS:
WATER: CEMENT LINED CLASS 350
FORCEMAIN: PROTECTO 401 LINED CLASS 350, LINERGARD 100
1. AMERICAN
2. UNION
3. TYLER
4. US PIPE
5. STAR
6. RUSSELL

ELECTRICAL EQUIPMENT
1. UNFUSED SAFETY SWITCH—SQUARE D
2. CABLE CONNECTORS—CROUSE-HINDS TYPE “CGB”
3. THERMAL-MAGNETIC AIR CIRCUIT BREAKER---SQUARE D
4. MAGNETIC MOTOR STARTER---SQUARE D
5. REDUCED VOLTAGE MOTOR STARTER---SQUARE D
6. EMERGENCY POWER RECEPTACLE—3W CROUSE-HINDS NO.
   AR1042-S22 WITH AR610 PANEL ADAPTOR FOR PUMPS LESS THAN
   25 HP & AR2042-S22 WITH AR610 PANEL ADAPTOR FOR PUMPS 25
   HP & LARGER.
7. PUMP MODE SELECTOR SWITCH—SQUARE D
8. INDICTATOR LAMPS—SQUARE D
9. ELAPSED TIME METER—EAGLE SIGNAL BULLETIN 705, HK SERIES
10. OR APPROVED EQUAL

FIRE HYDRANTS- 5 ¼ VALVE OPENING
1. CLOW MEDALLIAN F2545
2. MUELLER A-423
3. AMERICAN DARLING

**GENERATOR SETS**
1. CATERPILLER
2. CUMMINS/ONAN
3. KOHLER
4. KATOLIGHT
5. DETROIT DIESEL
6. TRADEWINDS
7. WINCO
8. ATLAS-COPO

**PE PIPE & TUBING**
3/4”-2” SDR 9 CTS
3”-48” DR11 DIPS
1. PHILLIPS
2. ENDOT/YARDLEY
3. POLYPIPE
4. JM
5. VANGUARD
6. FLYING “W”

**LIFT STATION ACCESS DOOR**
1. BILCO TYPE J-AL SINGLE LEAF W/S.S. HARDWARE (WATERPROOF)
2. HALIDAY SINGLE LEAF W/S.S. HARDWARE (WATERPROOF)

**LIFT STATION JOINT SEALER**
1. EMBECO GROUT (RAM NECK)

**LIFT STATION AND MANHOLE SEALANT AND COATINGS**
1. KOPPERS 300 COAL TAR EPOXY
2. TNEMEC

**LIFT STATION VALVE PIT ACCESS DOOR**
1. BILCO TYPE JO-AL DOUBLE LEAF
2. HALIDAY

**LIFT STATION VALVE PIT QUICK DISCONNECT**
1. KAMLOC MALE KWIK DISCONNECT KAMLOC COULPER 4”

**LINE SETTER- FOR WATER SERVICE METERS**
1. FORD C0. or EQUAL

**MARKER BALLS ELECTRONIC**
1. WATER: 3M 1403
2. SEWER: 3M 1404

**MANHOLES FRAMES AND COVERS**
1. U. S. FOUNDRY DWG. NO. 420A
2. PAMREX HINGED MANHOLE COVER AND FRAME

**MANHOLES FLEXIBLE PLASTIC GASKETS**
1. RAMNECK
2. CCI PIPELINE SYSTEMS, LLC – WRAPIDSEAL MANHOLE ECAPSULATION SYSTEM

**MANHOLE AND LIFT STATION LININGS (FIBERGLASS)**
1. ASSOCIATED FIBERGLASS ENGINEERS
2. LF MANUFACTURING COMPANY

**MANHOLE-PIPE CONNECTION(BOOT)**
1. KOR-N-SEAL INC --NEOPRENE BOOT WITH SS ACCESSORIES

**MANHOLE WATERTIGHT RAIN GUARD BOOT FOR MANHOLES**
1. FOSROC INC./THOROC SEWER GUARD 20.25 I.D. X 22.5 O.D.
2. LF MANUFACTURING COMPANY

**MECHANICAL JOINT RESTRAINTS**
1. FORD MEGALUGS & 1390-C
2. EBBA MEGALUGS & BELL RESTRAINTS
3. US PIPE FIELD LOCK GASKETS
4. AMERICAN FIELD LOCK GASKETS
5. SIGMA MEGALUGS & BELL RESTRAINTS
6. STAR

**METER BOXES**
1. POLYMER CONCRETE & FIBERGLASS BY CDR SYSTEMS CORP. SIZES 11”X18”, 13”X24”, 17”X30”, 24”X36” WITH PREDRILLED HOLE FOR TOUCH HEAD AND CI OPENING LID

**METERS FOR SEWER FORC MAINS**
MAG-METER (ON CASE BY CASE BASIS)
1. Fisher Porter
2. ABB

**PLUG VALVES**
1. DEZURIK SERIES 100
2. KENNEDY
3. CLOW
4. M&H
5. PRATT
6. VALVEMATIC SERIES 1500

**PVC PIPE**

WATER/FORCEMAIN: DR18 C900/C909

SEWER: SDR 35 3034

1. J-M MANUFACTURING COMPANY, INC.
2. ETI
3. DIAMOND
4. FREEDOM
5. CERTAINTED
6. NATIONAL
7. NORTH AMERICAN

**REDUCE PRESSURE BACKFLOW PREVENTER ASSEMBLY**

1. AMES 4000SS & 400SS
2. WILKENS 975
3. FEBCO 825Y
4. WATTS 909

**REMOTE TRANSMITTER UNIT**

1. Model TAC II telemetry unit, complete with Model PCU-001 pump control module, BPR backpack radio/TAC pack, power supply with battery backup, Model RTU-03 enclosure, cable and antenna, as supplied by Data Flow Systems, Inc.

**RESILIENT SEAT GATE VALVES**

1. M&H/KENNEDY
2. MUELLER
3. DEZURIK
4. PRATT
5. CLOW
6. AMERICAN DARLING

**SERVICE SADDLES- STAINLESS STEEL STRAPS/ EPOXY COATED**

1. SMITH BLAIR 317
2. ROMAC
3. JCM
4. FORD METER BOX CO.
5. CASCADE

**SEWER FITTINGS 3034**

1. HARCO
2. VASSALLO
3. MULTIFITTINGS
4. PLASTIC TRENDS
SLEEVE TYPE COUPLINGS
1. DRESSER STYLE 38
2. SMITH BLAIR STYLE 413
3. BAKER ALLSTEEL
4. JCM
5. FORD

SUBMERSIBLE PUMPS
1. FLYGT
2. ABS—If a grinder pump is proposed, only ABS type grinders pumps under 7.0 hp are permitted. ABS V2 PIRANA GRINDER PUMPS ARE NOT PERMITTED.

TAPPING SLEEVES (DUCTILE IRON)
1. MUELLER
2. AMERICAN
3. US PIPE
4. M&H
5. CLOW
6. KENNEDY

TAPPING SLEEVES (STAINLESS STEEL)
1. FORD FTSS
2. JCM 432
3. SMITH BLAIR 663
4. ROMAC
5. DRESSER

TIE RODS
1. TIE RODS SHALL BE STAINLESS STEEL

TRACE WIRE COVERING
1. SCOTCH “33” TAPE
2. SKRINK WRAP
3. SCOTCH KOTE WATERPROOFING COMPOUND

VALVE BOXES (461-S)
1. RUSSELL
2. TYLER
3. US FOUNDRY
4. STAR
5. GENERAL FOUNDRY

VALVE NAME PLATE
1. SHIEDOW BRONZE CORP. KINGWOOD, WEST VIRGINIA
2. WAGER COMPANY
3. LF MANUFACTURING COMPANY
I – GENERAL
II – DETAIL DRAWINGS
III – SPECIFICATIONS
IV – PERMIT APPLICATIONS
AND CHECKLISTS