

**STANDARD
CONSTRUCTION SPECIFICATIONS
FOR
WATER AND WASTEWATER**



**CITY OF WILDWOOD
UTILITY DEPARTMENT**

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February 2023

STANDARD CONSTRUCTION SPECIFICATIONS

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**STANDARD CONSTRUCTION SPECIFICATIONS
FOR THE
CITY OF WILDWOOD, FLORIDA**

The Specifications set forth herein provide minimum standards for the construction of water, sewage and reuse transmission and collection facilities, meeting the following conditions:

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

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

Water, sewer, and reuse improvements shall be in general accordance with the City's adopted planning documents.

Should any design be submitted which varies appreciably from the standards set herein or uses materials other than those recommended, it should be accompanied by appropriate supporting documentation or engineering studies and must be approved by the City of Wildwood, Utilities Director.

Please note that all plans submitted for review must be in conformance with all Federal, State, County, and City regulations and codes. Minimum standards will not be less than those established by recognized private and governmental agencies, unless stated otherwise in these specifications.

SECTION 1

GENERAL INFORMATION

1.1 AUTHORITY

- 1.11 Approval
- 1.12 Scope and Intent
- 1.13 Variances
- 1.14 Changes to These Standards

1.2 GENERAL

- 1.21 Pre-Design Conference
- 1.22 Inspection
- 1.23 Final Acceptance
- 1.24 Maintenance
- 1.25 Transfer of Private Ownership
- 1.26 Property Ownership
- 1.27 Testing

SECTION 1

GENERAL INFORMATION

1.1 AUTHORITY

1.11 Approval

These design standards are accepted and approved by the City Commission.

1.12 Scope and Intent

It is intended for these Construction Specifications to establish minimum engineering requirements for utility projects submitted to the City. The development procedures will apply to utility development and construction projects, both public and private, within the jurisdiction of the City of Wildwood.

1.13 Variances

Under extreme conditions with specific applications, the following procedures and policies may be altered to meet certain conditions that are beyond the control of the developer and provided such deviations or alterations are acceptable to the City. Final decisions concerning such alterations shall be made by the Utilities Director and/or the City Engineer.

1.14 Changes to These Standards

Changes to these standards may be made by the Utilities Director as deemed necessary to improve/maintain the integrity of the city utility systems.

1.2 GENERAL

The developer and his engineer are reminded that all water, reuse and sewer system components must be flood proofed against inflow and infiltration.

1.21 Pre-Design Conference

A pre-design conference between the owner, his engineer and the City is recommended prior to submittal of construction plans.

A) Utility Coordination

It shall be up to the developer to coordinate all utilities within his development.

B) Pre-Construction Conference

A pre-construction conference shall be held at least two (2) days before the commencement of construction. The developer shall be responsible for arranging this conference with the City.

Required insurance certificates will be provided by the developer to the City when work involves City property, Right-of-Way, or easements.

C) Completion

1) As-Built Drawings

Within two weeks following final inspection, the developer shall submit Record Drawings in compliance with this manual.

1.22 Inspection

A) Periodic

The City will periodically visit the project site to make a visual inspection of the progress of the work and methods of construction. Upon observation of work not done in accordance with the plans and specifications, the City will notify the developer's contractor, and request that necessary corrections be made or tests performed to assure compliance with the specifications, at no cost to the City.

All projects shall be subject to inspection during and upon completion of construction by an authorized representative of the City. Presence or absence of an inspector during the construction does not relieve the Owner and/or Contractor from adherence to the approved plans and specifications.

The work shall at all times be subject to inspection by authorized representatives of the City, and materials and/or workmanship found not meeting the requirements of approved plans and specifications shall be immediately brought into conformance with said plans and specifications.

An authorized representative of the City shall make final inspection of the project after completion to determine acceptability of the work. Before this final inspection can be made, the Owner/Contractor shall notify the City in writing that the work has been completed in accordance with the approved plans and specifications.

B) Final

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

C) Changes

All field changes to previously approved construction plans shall be in accordance with these specifications and approved by the City prior to implementation.

1.23 Final Acceptance

When facilities qualify as public facilities, the City will accept ownership of the completed facilities when the work has passed the final inspection, proper acquisition documents are completed, and acceptable Record Drawings are submitted to the City. The Record Drawings shall be completed by the Engineer of Record for the project and shall show final locations of sewer lines, manholes, valves, fittings, manhole rim and invert elevations, water mains, reuse mains, air release valves, and all other pertinent information related to the utility system.

Final acceptance by the City will be made in writing upon satisfactory completion of the project, including final inspection and submittal of the following documents to the Utilities Department:

1. Certifications of Completion from all Regulatory Agencies (i.e. Florida Department of Environmental Protection, Southwest Florida Water Management District, Florida Department of Transportation, etc.)
2. Recorded easement documents
3. Maintenance Bond in the amount of 10% or all contributed assets, with a duration of 1 year. Maintenance Bond to be accompanied by a letter prepared by the Engineer or Record documenting the Bond amount.
4. Copies of all approved Testing Results (i.e. Pressure Test, Air Test, Lamping, etc.)
8. Results of Bacteriological Sampling on water lines

Final acceptance by the City will be made in writing upon satisfactory completion of the project, including all items above. The Owner/Contractor shall warranty the work for a period of one year from the date of final acceptance and shall immediately correct any deficiencies in the work due to materials and/or workmanship which occur during the warranty period at no cost to the City. The date of final acceptance shall be the date on which the Owner/Contractor has fulfilled all conditions necessary for final acceptance.

1.24 Maintenance

All items or systems must be designed in such a manner to minimize future maintenance. A one-year warranty on all work shall be furnished to the City at the time of final acceptance, along with all warranties and manufacturers' manuals for all items to be maintained by the City. In addition, all submersible pumps shall be warranted for a period of five years. Warranties shall be extended by six months from the date of any repair to a warranted item. The City shall be provided five year warranties on all pumps, motors, electrical panels, etc. by the manufacturer prior to final acceptance by the City.

1.25 Transfer of Private Ownership

When transfer of private facilities to public ownership takes place, all such private facilities shall be brought up to the current City standards at no cost to the City insofar as construction and maintenance are concerned, before the City will accept such facilities. The City is to be furnished copies of all approvals; permits, certificates of completion, etc., to or from completion, etc. , to or from other agencies such as Sumter County, Florida Department of Environmental Protection, Southwest Florida Water Management District, Florida Department of Transportation, railroads, etc., before proceeding with construction. Proof of satisfactory completion of water and sewer facilities, positive water bacteriological tests, and submission of quick claim deeds, bills of sale, prior and current permits, warranties, manufacturers manuals, and a one year maintenance bond shall be furnished to the City prior to acceptance.

1.26 Property Ownership

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

1.27 Testing

It shall be the Contractor's responsibility to provide the necessary equipment and personnel for all inspections and testing, including televising the sanitary sewer laterals (if required). This shall include all safety equipment necessary to meet OSHA requirements. Inspections will be cancelled if proper testing or safety equipment is not on site and readily available at the time of the inspection.

Access to the work shall be provided by the Contractor for all required inspections. In cases where the Contractor has proceeded with work which the City had requested to inspect or witness without said requested inspection, the Contractor shall bear all costs associated with uncovering, retesting, additional testing, or any other means necessary to provide physical evidence as to the acceptability of the work performed by the Contractor. Such costs shall be the responsibility of the Contractor regardless of whether or not the work is found to be defective or acceptable to the City.

SECTION 2

UTILITY EXCAVATION, TRENCHING, AND BACKFILLING

- 2.1 GENERAL
- 2.2 MATERIALS
 - 2.21 Sheeting and Bracing
 - 2.30 Workmanship
 - 2.31 Trench Dimensions
 - 2.32 Utility Bedding
 - 2.33 Unsuitable Material Below Trench Grade
 - 2.34 Extra Utility-Bedding Material
 - 2.35 Sheeting and Bracing
 - 2.36 Excavated Material
 - 2.37 Material Disposal
 - 2.38 Borrow
 - 2.39 Dewatering
 - 2.40 Obstructions
 - 2.41 Backfill
 - 2.42 Roadway and Pavement Restoration
 - 2.43 Protection and Restoration of Property
 - 2.44 Cleanup

SECTION 2

UTILITY EXCAVATION, TRENCHING, AND BACKFILLING

2.1 GENERAL

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

2.2 MATERIALS

2.21 Sheeting and Bracing

- A) No wood sheeting shall be left in place.

2.3 WORKMANSHIP

2.31 Trench Dimensions

The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 inches for un-sheeted trench, or 12 inches for sheeted trench, and the maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the drawing details, or approved by the City.

2.32 Utility Bedding

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

2.33 Unsuitable Material Below Trench Grade

Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation material, unless special design considerations received prior approval from the City. Backfilling below trench grade shall be in compliance with the applicable provisions of subsection 2.41 "Backfill".

2.34 Extra Utility-Bedding Material

When rock or other non-cushioning material is encountered at trench grade, excavation shall be extended to 6 inches below the outside of the bottom of the utility, and a cushion of sand to fully cover the pipe or fittings to a minimum depth of 12" shall be provided.

2.35 Sheeting and Bracing

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

2.36 Excavated Material

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

2.37 Material Disposal

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

2.38 Borrow

Should there be insufficient satisfactory material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured by the contractor and with material approved by the City.

2.39 Dewatering

Utilities shall be laid "in the dry" unless otherwise approved. Dewatering systems shall be utilized in accordance with good standard practice and must be efficient enough to lower the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry. Any dewatering equipment to be utilized in a residential area shall be equipped with a sound attenuating enclosure and approved by the City.

2.40 Obstructions

It shall be the contractor's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts.

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

2.41 Backfill

- A) Backfill material shall be clean earth fill composed of sand, or other City approved fill.
- B) When trenches are cut in pavements or areas to be paved, compaction as determined by AASHTO Specification, shall be, for each 12 inch backfill lift, equal to 98 percent of maximum density, with compaction in other areas, not less than 95 percent of maximum density. Density tests shall be provided for trenches within pavement, across roads and areas adjacent to proposed building structures.

Backfilling of pipe trench or under and around structures shall be, for each 12 inch backfill lift, compacted to 98 percent of maximum density as determined by AASHTO Specification.

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

- C) If, in the opinion of the City, densities are questionable, additional density tests for determination of compliance with the above specified compaction requirements shall be made by a testing laboratory approved by the City at the expense of the contractor. Test locations will be determined by the City.
- D) If any test results are unsatisfactory, the contractor shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained.
- E) Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed pipe against excessive loads across roadways and river/swamp areas, as required by the City.
- F) Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired by the contractor at his expense.
- G) All water, reuse and sewer lines must have a continuous metallic tracing tape placed 18" above them, labeled with the appropriate designation of pipe use.
- H) All open trench and direct buried water, reuse and sewer force mains shall be installed with a continuous run of #10 AWG solid, copper clad steel tracer wire attached to the top of pipe every ten (10) feet and pulled up into all valve boxes and all meter boxes. Wire shall have a 30 mil HDPE jacket and must be BLUE for potable water, GREEN for sewer, and PURPLE for reuse. Wire shall have a minimum break load of 448 lbs. Wire shall be Proline Safety Products Pro Trace HF-CCS-PE 30 or City approved equal. All wire splices shall utilize Tracer-Lock wire connector (#TL-LUG-SS) as manufactured

by Proline Safety Products on all mainline and lateral connections. Twist style wire nuts and split bolts will not be acceptable. Continuity for the entire length of tracer wire shall be required to be tested as described in section 4.41 (K) tracing wire testing.

- I) No pipe or piping shall be backfilled until inspected and approved by the City.
- J) All piping shall be laid with the lettering facing up for identification purposes.

2.42 Roadway and Pavement Restoration

Open cuts of City streets are discouraged. However, hardship waivers may be granted at the sole discretion of the Public Works Director, in accordance with the requirements of this section of these specifications. Restoration shall be as required by the Public Works Director, taking into account factors such as age of existing roadway, density of traffic, location, etc.

- A) Pavement or roadway surfaces cut or damaged shall be replaced by the contractor in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter, or other appurtenances. The contractor shall obtain the necessary permits and all applicable authorizations from the proper agencies prior to any roadway work. Additionally, the contractor shall provide advance notice to the appropriate authority and local emergency services agencies, as required, prior to construction operations.
- B) Restoration shall be in accordance with requirements set forth by the City. The materials of construction and method of installation, along with the proposed restoration design for items not referred to or specified herein, shall receive prior approval from the City.
- C) Where existing pavement is removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
- D) Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration.
- E) Density tests shall be provided for trenches in pavement across roadways.

2.43 Protection and Restoration of Property

During the course of construction, the contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and

structures within the construction right-of-way, easement or site, and take full responsibility for repair or replacement thereof.

2.44 Cleanup

Work site cleanup and property restoration shall follow behind construction operations without delay. Some of this clean-up will be done on a daily basis, as needed, usually at the end of the workday.

SECTION 3

BORING AND JACKING

3.1 GENERAL

3.2 MATERIALS AND INSTALLATION

3.21 Dimensions and Material

3.22 Areas Not Under Jurisdiction

3.23 Workmanship

SECTION 3

BORING AND JACKING

3.1 GENERAL

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

3.2 MATERIALS AND INSTALLATION

3.21 Dimensions and Materials

Casing pipes crossing under City roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum 36 inches depth of cover between the top of the casing pipe and surface of the roadway where practicable. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139, Grade B.

3.22 Areas Not Under Jurisdiction

For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the City, the contractor shall comply with the regulations of said authority in regard to design, specifications and construction. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size be less than that specified in City of Wildwood Detail W-16.

3.23 Workmanship

A) The boring and jacking operations shall be done simultaneously with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring butt welded to the preceding length, developing water-tight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities.

Following placement of the carrier pipe within the steel casing, masonry or bituminous plugs are to be installed at each open end.

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

C) The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressure.

D) Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced and dewatered as required.

The distance between the edges of the jacking pit and the pavement is 6 feet minimum.

E) The carrier pipe shall be either Pressure Class 350 ductile iron pipe, a solid steel pipe, or PVC with restrained joints. The carrier pipes shall be supported by pre-manufactured stainless steel casing spacers within the casing pipe. Wooden skids will not be allowed.

SECTION 4

PIPE, FITTINGS, VALVES, AND APPURTENANCES

4.1 GENERAL

4.2 PIPE AND FITTINGS

4.21 General

4.22 Cast and Ductile Iron

4.23 Polyvinyl Chloride (PVC)

4.24 HDPE Pipe & Tubing

4.25 Polyethylene Plastic Tubing

4.26 Copper Pipe and Tubing

4.27 Special Items

4.3 VALVES

4.31 General

4.32 Backflow Devices

4.33 Check Valves

4.34 Plug Valves (PV)

4.35 Butterfly Valves

4.36 Valve Boxes

4.37 Meter Boxes

4.38 Fire Hydrants

4.39 Service Lines

4.40 Water Meters

4.4 INSTALLATION

4.41 General Requirements

SECTION 4

PIPE, FITTINGS, VALVES, AND APPURTENANCES

4.1 GENERAL

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

4.2 PIPE AND FITTINGS

4.21 General

All pressure pipe and fittings shall be clearly marked with the name or trademark of the manufacturer. All pressure pipe and fittings shall be suitable for 150 p.s.i. working pressure and shall meet all applicable ANSI/AWWA specifications. All pipe installations shall have indicator tape run with pipe to indicate the purpose of piping (water, sewer, force main) and copper tracing wire for location purposes.

4.22 Ductile Iron

- A) Ductile iron pipe shall be in accordance with ANSI/AWWA C151/A21.51. Pipe shall be laid in accordance with ANSI/AWWA C150/A21.50. Thickness class shall be governed by design conditions, minimum pressure class shall be 350.
- B) Cast and ductile iron pipe fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C153/A21.53. All underground fittings shall be mechanical joint, unless otherwise specified.
- C) Joints
 - 1) "Push-On" and mechanical type joints shall be in accordance with ANSI/AWWA C111/A21.11.

- 2) Restrained joint assemblies with mechanical joint pipe shall be Mechanical Joint Retainer Glands, "locked-type" joints of EBBA Megalug Series 1100, Tyler Series 100, Tuff Grip, or approved equal.
- 3) Flanged connections shall be in accordance with ANSI/AWWA C115/A21.15, 125 lb. standard.
- 4) No leaded joints or connection of any kind will be permitted.
- 5) PVC fittings for pressure mains are prohibited above 2 inches in diameter, unless otherwise specifically approved by the City.

D) Coatings and Linings

- 1) Ductile iron pipe and fittings for force mains or when used as gravity sewer service shall receive an interior epoxy lining for both pipe and fittings in accordance with AWWA C210.
- 2) Ductile iron pipe and fittings for water and reuse service shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4.
- 3) Ductile iron pipe and fittings for water, sewer and reuse shall receive an exterior asphaltic coating approximately 1 mil thick. The coating shall be applied to the exterior of all pipe and fittings unless otherwise specified. Coatings shall be applied in accordance with AWWA C110 & C153-fittings, AWWA C115-flanged pipe, and AWWA C151-ductile iron pipe.

4.23 Polyvinyl Chloride (PVC)

- A) Pipe shall be manufactured from clean virgin Type I, Grade I rigid, polyvinyl chloride resin (Class 12454-A or Class 12454-B) conforming to ASTM D1784. The PVC compound shall have an established hydrostatic design basis (HDB) of 4000 psi as described in ASTM D2837. The pipe shall bear the National Sanitation Foundation (NSF) seal for potable water pipe. Pipe with diameters less than 4" shall be Class 200 with a minimum Standard Dimension Ratio (SDR) of 21 and shall be in accordance with ASTM D-2241.

Potable water main pipe with diameters of 4" and above shall have a minimum dimension ratio (DR) of 18, (235psi), and shall be manufactured in accordance with AWWA Specification C-905 latest revision or Pressure Class 350 ductile iron pipe (per Section 4.22) may be used. Pipe with diameters of 4" to 24" for sewer force mains shall have a minimum dimension ratio (DR) of 18, (235psi), and shall be manufactured in accordance with AWWA Specification C-905 latest revision or Pressure Class 350 ductile iron pipe (per Section 4.22 may be used). Sanitary gravity sewer main pipe shall have a minimum standard dimensional ratio (SDR) of 35, for installations up to 15 feet in depth, and shall be manufactured in accordance with ASTM D3034. Sanitary

gravity sewer main pipe shall have a minimum standard dimensional ratio (SDR) of 26 for installations deeper than 15'.

PVC Pipe Restrainers shall be EBBA Megalug Series 2000, EJ Tuff Grip, or approved equal.

PVC PIPE COLORS

WATER - Blue
SEWER - Green (Force main); Green (Gravity Sewer)
REUSE - Purple

- B) Connections and fittings for pipe 1 ½" and smaller shall be solvent welded sleeve type joint. Connections and fittings for pipe 2" and 2 ½" in diameter shall be rubber compression ring type. Pipe shall be extruded with integral thickened wall bells without increase in DR. Rubber ring gaskets shall consist of synthetic compounds meeting the requirements of ASTM Designation D1869, and suitable for the designated service. Fittings for Pressure mains 3" and larger (water lines or, sewage force mains) shall be ductile iron with mechanical joint rubber compression ring type joints.
- C) All piping (PVC, Polyethylene tubing) shall have a AWG #10 solid, copper clad steel tracer solid strand wire that is attached to the top of pipe at ten (10) foot intervals, continuous run with splices allowed using Tracer-Lock wire connector (#TL-LUG-SS).

4.24 High Density Polyethylene (HDPE) Pipe and Tubing

Pipe and tubing shall comply with AWWA C906, AWWA C800 and AWWA C901, and be certified for potable water service by the National Sanitation Foundation.

A) Materials

1) Pipe and Fittings:

The pipe supplied under this specification shall be high performance, high molecular weight, high density polyethylene pipe, PE 3408. The pipe shall conform to ASTM D 1248 (Type III C, Class C Category 6\5, P.O. 3408). The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. Fitting connections shall be made with flange adaptors utilizing 316 stainless steel back up rings and 316 stainless steel hardware. A separate ½" Schedule 40 PVC conduit shall be installed on the top side of the HDPE directional bore containing 14 Gauge tracing wire. All HDPE directional bores larger than 2" in diameter shall have fusion welded fittings and ends for connection.

2) Tubing and Fittings:

The tubing supplied under this specification shall be high performance, high molecular weight, high density polyethylene tubing, PE 3408. The pipe shall conform to ASTM D 1248 (Type III, Grade P34, Class A, Category 5). The tubing shall be blue as manufactured by Endot Industries Endot Endopure or approved equal. The fittings shall be brass, equipped with compression type connections.

3) Quality Control:

The pipe and tubing shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density melt index, and other physical properties.

The engineer may request certification that the pipe produced is represented by the quality assurance data. Additionally, test results from manufacturer's testing which shows the pipe does not meet appropriate ASTM standards or manufacturer's representation, can be cause for rejection. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM, D 3350, 10.1.9.

The owner or the specifying engineer may request certified lab data from the manufacturer to verify the physical properties of the materials supplied under this specification or at his own expense may take random samples for testing by an independent laboratory.

Polyethylene pipe, tubing and fittings may be rejected for failure to meet any of the requirements of these specifications.

B) Material Dimensions:

Pipe for sizes 4" and larger supplied under this specification shall have a nominal IPS (iron pipe size) O.D. and shall be rated for a minimum working pressure of 160 psi with a minimum Standard Dimension Ratio (SDR) of 11 for force and water main pipes.

C) Construction Practices

1) Trench Construction

The trench and trench bottom shall be constructed in accordance with ASTM Standard D 2321-Section 7.

2) Embedment Material

Embedment materials shall be Class I, Class II, or Class III materials as defined by ASTM D 2321-Section 6. The use of Class IV and Class V materials for embedment is not recommended and shall be done only with the approval of the engineer.

3) Bedding

Bedding of the pipe shall be performed in accordance with ASTM Standard 2321-Section 8. Compaction rates shall be as specified in ASTM D 2321. Deviations from the specified compaction must have the approval of the engineer.

4) Haunching and Initial Backfill:

Haunching and initial backfill should be as specified in ASTM D 2321-Section 9 using Class I, Class II, or Class III materials. Materials used and compaction rates shall be as specified by the engineer. In cases where a compaction rate of 85% Standard Proctor Density is not attainable, the engineer may wish to increase the SDR of the pipe to provide adequate stiffness.

5) Special Conditions:

ASTM D 2321-Section 11.2, minimum cover for load applications, section 11.3, use of compaction equipment and section 11.4, removal of trench protection should apply unless directed otherwise by the engineer.

6) After polyethylene piping is installed and backfilled, the contractor shall apply an initial hydrostatic pressure to the pressure listed in the piping schedule shown on the drawings. The initial test pressure shall be allowed to stand without make-up pressure for a period of time as required by the pipe manufacturer and approved by the engineer to allow for diameter expansion or pipe stretching to stabilize. After the required equilibrium period the test section shall be returned to the original test pressure.

7) HDPE Pressure Testing Procedures:

The initial pressure test can be conducted before the line is backfilled. However, it is advisable to cover the pipe at intervals or particularly at curves to hold the pipe in place during pressure test. Flanged connections may be left exposed for visual leak inspection. The main shall be tested after the final installation is completed.

Test pressure should not exceed 1.5 times the rated operating pressure of the pipe or the lowest rated component in the system.

The initial pressure test shall be applied and allowed to stand without make up pressure for a sufficient time to allow for diametric expansion or pipe

stretching to stabilize. This usually occurs within 2 to 3 hours. After this equilibrium period, the test section can be returned to the 1.5 times operating pressure, the pump turned off, and a final test pressure held for 2 hours.

Testing shall be in compliance with AWWA standards and as outlined in Section 10.4 of this manual

Under no circumstances shall the total time under test exceed 3 hours at 1 ½ times the pressure rating. If the test is not completed because of leakage, equipment failure, or other reason, the test section shall be permitted to 'relax' for 8 hours before the next testing sequence.

4.25 Polyethylene Plastic Tubing - 2" and less

Tubing shall comply with AWWA C800 and AWWA C901, be approved for potable water service by the National Sanitation Foundation and bear the NSF seal. Tubing shall be SDR9, 200 psi, Type III, Grade P-34, Class C, blue in color (manufactured by ENDOT-ENDOPURE, or approved equal). The product shall be rated for a minimum working pressure of 200 psi with a minimum Standard Dimension Ratio (SDR) of 9. Fittings shall be brass, equipped with compression type connections.

4.26 Copper Pipe and Tubing

Pipe or tubing shall meet AWWA C-800. Fittings shall be brass, with approved compression connections.

4.27 Special Items

A) Tapping Sleeve -

Any tap or valve installation into the existing City system shall be made by the City or approved agent at the expense of the Developer. Sleeve shall be Ford Fast Tapping sleeve, Mueller T2360 tapping valve, EJ FLOW MASTER, or approved equal.

B) Service Saddles

Shall be Ford #F202 Series, double strap with IP outlet, or City approved equal. Sealing gasket shall be BUNA-N rubber and straps shall be steel w/brass corporation stop (Ford FB100-NL) or resilient seated gate valve.

4.3 VALVES

4.31 General

The valve type, size, rating, flow direction arrow if applicable, and manufacturer shall be clearly marked on each unit. Valves shall open left (counterclockwise) with an arrow cast in the metal of operation hand wheels and nuts indicating the direction of opening. Valves shall be located on each leg of every tee and cross using an (n-1) formula per AWWA standards.

A) Gate Valves for Underground Service

Valves from 2" thru 12" for underground service shall be iron body gate valves, non-rising stem type and shall be equipped with a 2" square cast iron operating nut with corrosion protection coating inside and out. Resilient seated valve which meets all C-509 requirements of AWWA (water). Acceptable manufacturers are Mueller A2370-20, American Darling CRS-80, EJ Flowmaster, or Kennedy. All dead-end lines will have valves at the end equal to the size of main line with blow off attached. End line valves shall be adequately restrained to the pipeline such that they may be excavated, and the line extended without shutting off line pressure.

Tapping valves shall be resilient seat gate valves as manufactured by either Mueller or EJ Flowmaster.

B) Valves for Above-Ground Service for Water Systems Only

Valves shall be flanged iron body, bronze mounted resilient seat gate valves, conforming to AWWA C-509, with the exception that valves shall be outside stem and yoke (OS & Y) rising stem type. Valves shall have cast iron hand wheels or chain operators with galvanized steel chains, as required. Valves for fire suppression system shall be approved by Sumter County fire officials and a detector valve shall be required on all dedicated fire lines.

C) Valves Smaller than 2 Inches

Valves smaller than 2 inches shall be iron body gate valve w/rising stem and 2 inch operating nut, conforming to Federal specifications 150 psi minimum working pressure with threaded joints equal to American 3 FG or City approved equal.

4.32 Backflow Devices

A) All services are to be protected by a backflow prevention device suited to the highest degree of hazard encountered at the connection. Maintenance of the device is to remain the responsibility of the Utility customer, including proper certifications.

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

Double check valves shall be Watts #709 Series 3/4" thru 10". Double check valve assembly from 2 1/2" and up shall be furnished with OS & Y gate valve shut-offs.

- C) All commercial services shall be equipped with a reduced pressure zone backflow prevention device. Reduced pressure zone valve shall be designed to specification of the USC Cross Connection Control Laboratory, and A.S.S.E. #1015. Reduced pressure zone valve shall be Watts Series 919, Wilkens 975XL, or Apollo RPLF4A for sizes 3/4" thru 10". Reduced pressure zone valve assembly from 2 1/2" and up shall be furnished with OS&Y gate valve shut-offs.
- D) Pressure vacuum breaker shall be designed to specification of USC Cross Connection Control Laboratory, A.S.S.E. #1020. Spring loaded single float and disc with independent water inlet and air inlet valves. Furnished with shut-off valves and ball type test cocks. Pressure vacuum breaker shall be Watts #800.
- E) Shut-off valves on backflow assembly for sizes 3/4 inch through 2 inches shall be provided with ball valves, assemblies above 2 inch shall be provided with resilient seat full flow gate valves.
- F) Fire sprinkler systems to have a Double Detector check valve assembly (D.D.C.)

4.33 Check Valves

Valves for wastewater application shall be iron body, bronze mounted stainless steel hinge pin, outside lever and spring operated, swing type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe. Mueller #2600-6-02, American Darling #52SC, or Kennedy or M & H equivalents.

4.34 Plug Valves

Valves for water and wastewater application shall be epoxy lined, semi-steel body, non-lubricated, eccentric type plug valves, with resilient faced plugs, and capable of drip-tight shut-off at the rated pressure if applied at either port. Operation of all valves 8" or larger, and smaller sizes in exposed locations which require hand wheels or chain wheels, shall be by approved gear actuators, equipped with position indicator and stop, and shall be furnished by the valve manufacturer. Gear actuators for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron hand wheels or chain operators, with galvanized steel chains, as appropriate for the installation and type of operator. Valves and appurtenances shall be Series 100, as manufactured by DeZurik Corp., or approved equal.

4.35 Butterfly Valves

Valves larger than 12" shall be cast iron body, self-lubricated, resilient seated, one-piece stainless steel shaft, and capable of drip-tight shut-off at the rated pressure and meet AWWA C504. Valve operators shall conform to AWWA C504. Valve operator for buried or submerged

installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron handwheels or chain operator as appropriate for the installation and type of operator. Valves shall be installed in a vertical position. Valves and appurtenances shall be DeZurik Series 130, American-Darling 150 or Pratt. All valves shall be accompanied by a 3-inch diameter bronze valve marker anchored in the concrete pad which indicates size of valve, type of valve, service (water, sewer, etc...) and direction and number of turns to open.

4.36 Valve Boxes

Units shall be adjustable, cast iron, minimum interior diameter of 5", with covers cast with the applicable inscription in legible lettering on the top; "SEWER", "REUSE" or "WATER". Boxes shall be suitable for the applicable surface loading and valve size. Valve boxes not in the pavement shall have around their tops concrete pads, which will be flush with the top of the curb, round with beveled edge with rebar as per attached details, accompanied by a 3" diameter bronze valve marker anchored in the concrete pad which indicates size of valve, type of valve, service (water, reuse, sewer, etc...) and direction and number of turns to open.

4.37 Meter Boxes

Plastic meter boxes shall be DFW – ROTEC, #36F or 39F with overlap lid, plastic with cast iron meter reader, or approved equal.

4.38 Fire Hydrants

Fire hydrants shall be of Mueller Super Centurion 200 oil reservoir, American Darling 6" B-84-B, 5-1/4", or Kennedy KD1-D with traffic breakaway flange and 5-1/4" valve.

4.39 Service lines

All fittings shall be Ford, Mueller, or McDonald brass. One inch (1") corporation stops shall be Ford FB1100, or Mueller 25028. Two inch (2") corporation stops shall be (MIP x MIP) Ford FB500. Curb Stops (lock wing), shall be in accordance with the table below:

Size	Type	Ford	Mueller
3/4"	FIP x FIP	B11-233W	B20200 R
3/4"	FIP x SPUD	B13-232W	B24351 R
1"	FIP x FIP	B11-344W	B20200 R
1"	FIP x SPUD	B13-344W	B24351 R

Note: Service layout must be approved by the City.

4.40 Water Meters

All meters shall be Neptune and supplied by the City at the expense of the utility customer, up to 2". All meters larger than 2" shall be purchased by the City and billed to the utility customer.

4.4 INSTALLATION

4.41 General Requirements

- A) Piping, fittings, valves and appurtenances shall be installed in accordance with these Standards and/or approved by the City of Wildwood Utilities Department.
- B) Piping shall be installed along straight line and grade between fittings, manholes, or other defined points, unless definite lines of alignment, deflection or grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the City and all resulting design considerations shall be resolved by the contractor.
- C) Materials shall be cleaned and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris, and when work is not in progress, all open ends shall be plugged.
- D) Pipe, valves, fittings, or other items shall be inspected prior to installation, and any items showing a fracture or other defect shall be rejected. However, ductile iron pipe showing an end crack, with no fracture indicated beyond that visible, may be salvaged by cutting off the damaged section 12" past the crack, providing the remaining pipe is sound.
- E) Underground piping shall not be driven to grade by striking it with an unyielding object. when the pipe has been properly bedded, enough compacted backfill shall be placed to hold the pipe in correct alignment. If necessary, precaution should be taken to prevent flotation.
- F) Jointing shall be by an approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point.
- G) "Mega-Lug" or EJ Tuff Grip restrained joints shall be provided at all bends, wyes, tees, caps, valves, hydrants and reducers. If any joints are within the required restrained length, they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the plans or according to the pipe manufacturer's recommendations when not shown on the plans and approved by the City.
- H) Disinfecting of all potable water pipes shall be accomplished by the contractor following approved pressure testing. Unless alternate procedures are set forth under

the applicable service Standard, said disinfecting procedures shall be in accordance with AWWA Standard C651.

- I) Ductile Iron Pipe installation shall be performed in accordance with the applicable provisions of the latest AWWA Specifications.
- J) Polyvinyl Chloride (PVC) pipe-lubrication and/or solvent for pipe and fitting Joints shall be non-toxic (NSF approved for potable water). Following making, solvent type joints shall not be disturbed for 5 minutes and shall not have internal pressure applied for 24 hours, or as recommended by the pipe manufacturer.
- K) Tracer Wire and Warning Tape - Where non-metallic pipe is installed, #10 tracer wire and warning tape shall be installed to facilitate future location of the mains.

Tracer wires shall begin and terminate in the valve boxes. Wire shall run continuously through valve boxes for the entire length of the pipeline and shall be strapped to the pipe at (10) ten-foot intervals. Boxes shall be installed at each location as shown on the plans. Tracer wire between boxes shall be continuous, in unbroken lengths. The tracer wire shall not be installed in tension, but neither shall there be “coils” in the wire. The ends of the tracer wire shall be installed in the boxes as per City Detail (W-08) Gate Valve and Box Detail. The length of each tracer wire in each box shall be long enough to extend no less than one (1) foot and no greater than two (2) feet above ground level. All breaks shall be repaired by splicing with Tracer-Lock wire connector (#TL-LUG-SS) or pre-approved equal as described in section 2.41 Backfill (H) Repairs by “twisting” the two ends together utilizing wire nuts, split bolt, duct tape or other methods will not be acceptable.

Tracing wire testing – After construction and backfilling is complete, but before final inspection, the City inspector will test the #10 tracer wire with standard City locating equipment. If the inspector determines that the tracer is not operating properly, the Contractor shall locate and correct the problem. The main will not be accepted and placed in operation until the tracer system is acceptable to the satisfaction of the City.

Warning tape - shall be buried in the backfill approximately one foot over the top of the PVC main. Tape shall be laid in continuous lengths. Any breaks or tears shall be repaired before proceeding with backfilling operations.

SECTION 5

SANITARY GRAVITY SEWERS

- 5.1 GENERAL
- 5.2 STANDARD REQUIREMENTS
- 5.3 MANHOLES
- 5.4 PIPE BEDDING
- 5.5 CONNECTIONS AT STRUCTURES
- 5.6 TRANSITION CONNECTIONS
- 5.7 PIPE CUTTING
- 5.8 SERVICE CONNECTIONS
- 5.9 POLYVINYL CHLORIDE (PVC) SEWERS
- 5.10 TESTING

SECTION 5

SANITARY GRAVITY SEWERS

5.1 GENERAL

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

5.2 STANDARD REQUIREMENTS

A) General

The materials of construction and general installation procedures shall comply with the Specific applicable standards set forth under Section 2, "Utility Excavation Trenching and Backfilling", Section 3, "Boring and Jacking" and Section 4, "Pipe, Fittings, Valves and Appurtenances".

All gravity sewer systems shall be designed to meet the Florida Department of Environmental Protection's slope standards.

5.3 MANHOLES

- A) Manholes shall be precast concrete. The minimum inside diameter of manholes shall be 48 inches for sewer sized to 21 inches in diameter or less, with submittal of special designs for larger pipes. Manholes are to be placed at the ends of jack and bore section for gravity sewer lines.
- B) Precast reinforced manholes shall be in accordance with ASTM Designation C478, with pre-formed flexible plastic joint sealer conforming to Federal Specification SS-S-0210 (GSA-FSS), "Ram-Nek", as manufactured by the K.T. Snyder Co., Inc., Houston, Texas or approved equal.

Cement shall meet the requirements of ASTM C150 – latest revision, specifications for Portland cement, type II. Concrete shall have a minimum compressive strength of 4000 psi. Minimum wall thickness shall be 5", or 1/12 the inside diameter, whichever is greater. Rings shall be custom made with openings, to meet indicated pipe alignment conditions, and invert elevations.

Joint contact surfaces shall be formed with machined castings. They shall be exactly parallel with a 2:1 slope and nominal 1/16" clearance with the tongue equipped with a proper recess for the installation of an O-ring rubber gasket, conforming to ASTM C443 – latest revision.

With the exception of joint contact surfaces, and the interior surfaces of all openings to receive the sewer pipe and a 1" annular ring around the exterior and interior of said openings, the interior and exterior surfaces of each manhole shall be given two coats of

coal-tar epoxy (Koppers Bitumastic No. 300M , or approved equal). Total minimum dry film thickness shall be 12 mils. Each coat shall be applied at the rate of one gallon per 100 s.f. The waterproofing materials shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat. The coal-tar epoxy shall be applied at the place of fabrication. Additional coating or touch up will be required after manhole installation if so directed by the engineer.

- C) Manhole frames and covers shall be gray cast iron conforming to ASTM Designation A48 latest revision, Class 30 or grade 65-45-12, ductile iron, meeting the requirements of ASTM A536, latest revision, and shall have a minimum 22 " opening. In either case, manhole frame and cover shall be designed to withstand an HS20-44 loading defined in the AASHTO specifications. Frames and covers shall be machined or ground at touching surfaces so as to seat firmly and prevent rocking. Castings shall be made of good quality, strong, tough, even grained cast iron, and shall be smooth, free from scale, lumps, blisters, sandholes, and defects of any nature which should render them unfit for the service for which they are intended. They shall be thoroughly cleaned and subjected to a careful hammer inspection. Covers shall have no perforations and shall be marked with the word "Sewer". Frames and covers shall be fully bedded in mortar to the correct finish grade elevation, with adjustment brick courses placed below, as detailed for precast manholes.
- D) Manhole flow channels shall have smooth and carefully shaped bottoms, built up sides and benching constructed from concrete. Channels shall conform to the dimensions of the adjacent pipe and provide changes in size, grade and alignment evenly.
- E) Sewer clean-outs not in the pavement shall have around their tops in concrete pads, which will be flush with the top of the curb, with minimum dimensions of 18 to 18 by 3 inches, except in residential areas where they will be 2.5 ft diameters concrete rings, painted green.
- F) Unless a drop connection is installed, pipes shall match crown to crown at all manhole locations.
- G) Manholes either existing or new that is determined to be receiving "Turbulent" water will require a "AGRU SURE GRIP" HDPE liner or a pre-approved equal by the City.

5.4 PIPE BEDDING

Special care shall be exercised in the design and installation to provide adequate bedding for the type of pipe used, taking into consideration trench width and depth, superimposed loadings above grade and the material below trench grade.

Pipe loadings capabilities shall be computed in accordance with established design criteria and special supporting bedding or facilities shall be provided as required.

5.5 CONNECTIONS AT STRUCTURES

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

5.6 TRANSITION CONNECTIONS

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

5.7 PIPE CUTTING

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

5.8 SERVICE CONNECTIONS

Installation shall be performed by the proper methods, including the wye branches installed in the sewer main at the point of connection, and the service pipe and required fittings extended to the property line or easement line, perpendicular to said line. The minimum service pipe size shall be 4 inches in diameter for single family residential connections and 6 inches in diameter for multi-family or commercial connections. A clean-out/plug is required to be installed on all connections at the right-of-way line.

Service lines shall be connected to the sewer lines by means of a wye fitting. IN the absence of an existing wye, connections of new services to existing mains shall be made by installing a saddle type fitting of the same manufacturer as the pipe. The branch of the wye fitting will be elevated as directed depending on the depth of the sewer and the elevation of the property to be served.

Service lines shall extend from the sewer to the property line and be plugged, unless, otherwise shown. Markers shall be installed at the end of each service or opposite wyes and their locations recorded.

Installation of plugged wyes, where indicated on the drawings will be made as directed. Plugs shall be of the type and size required to match the pipe and shall be water-tight and removable without breaking the pipe.

5.9 POLYVINYL CHLORIDE (PVC) SEWERS

A) General

This section includes the material and installation standards for pipe, fittings and appurtenances as applicable to PVC sanitary gravity sewer systems. The relevant provisions included in these specifications and standards shall be applicable to this

Section, unless otherwise indicated herein or approved by the applicable Regulatory Agency.

B) Materials

Polyvinyl Chloride (PVC) pipe and fittings for gravity sewage lines shall be manufactured from polyvinyl chloride resin conforming to ASTM Designation D1784. Pipe and fittings of this material shall conform to ASTM Designation D-3034 of F-949. All pipe and fittings shall have a Standard Dimension Ratio (SDR) of not more than thirty-five (35) for sewer mains 15' deep, or less. For sewer mains installed at greater than 15' depth, a minimum of SDR 26 PVC pipe shall be used.

C) Pipe Lengths

PVC pipe for gravity sewers shall be furnished in a maximum of thirteen (13) feet lengths, with integrally formed bell joints.

D) Joints

PVC pipe and fittings for gravity sewers shall be furnished with joints conforming to ASTM D-3212, Standard Specification for Sewer Pipe Joints using Elastomeric Seals. All pipes shall have a factory installed rubber sealing ring. Field solvent weld fittings shall not be acceptable.

E) Manhole Connections

All holes in manholes and/or wetwells shall be sealed utilizing a Kor-N-Seal boot.

F) SPECIAL BACKFILL

Where the soil in the excavated trench bottom is unsuitable (unstable), the contractor shall over excavate the trench bottom and backfill with crushed stone or gravel defined as Class I, except sizing shall be 1/4" to 3/4", under the U.S.C.S. Soil Classification System (FHA Bulletin No. 373), or crushed shell. In dry conditions, graded sands may be used.

G) PVC Pipe Laying and Backfill

(1) Dewatering Required

Water shall not be allowed in the trenches while the pipe is laid. The use of a dewatering system is a requirement on any runs of pipe where such pipe will be below the ground water elevation at the specific Site. Sump and pump type trenching may be used only on short shallow runs where well points would be impractical and excessively expensive, and only with the prior approval of the applicable Regulatory Agency. In all cases, density testing up to a point at least one (1) foot above the water table shall be completed prior to removal of

dewatering equipment. On sewer lines installed using dewatering, service laterals shall be installed while the trench is dry.

(2) Pipe Alignment

Care must be taken to fit the joints together properly so that the centers of the pipes shall be in a straight line. All adjustments to line and grade must be made by scraping away or filling in under the barrel of the pipe and not by wedging or blocking up any portion of the pipe. In no case shall the pipe be walked on either before or after the joints have been made. Any pipe that has its grade alignment or joints disturbed will be taken up and relaid. Pipe shall not be driven to grade by striking it with any unyielding object.

(3) Backfill and Deflection

Immediately after the pipe has been jointed and inspected, backfilling shall be placed to a minimum of twelve (12) inches above the crown of the pipe to adequately protect the pipe from injury and movement, in accordance with ASTM D2321. Before and during the backfilling of any trench, precaution should be taken against flotation of pipe lines therein due to entry of large quantities of water into the trench which could cause uplift of the pipe line. The diameter deflection of PVC pipe shall not exceed five (5) percent after completion and approval of construction, and for a period of one (1) year thereafter.

The backfill for the first and second stages shall be placed in 12" layers (compacted thickness).

Where pavement is to be constructed over the pipe or within 4' thereof, the backfill for the third stage (min. 4' below finish grade) shall be placed in the manner required for the first and second stages. Where the construction is outside these limits, the third stage shall be compacted to a firmness approximately equal to that of the adjacent soil and no testing well be required.

(4) Compaction

The mechanical compaction of backfill over sewer lines and appurtenances, within right-of-way and under all roadways, drives (including dirt drives), and parking areas shall be compacted to 95% to 4' below final grade, and then 98% for top 4' per AASHTO T-180. In unpaved areas outside of the right-of-way, the backfill shall be compacted to a minimum density of ninety-five (95) percent of maximum density.

When soil borings are provided by the engineer or owner, they shall be considered as supplemental information and shall not be considered as definitive of the subsoil conditions. The contractor is fully responsible for assessing subsoil conditions for the entire project.

The contractor shall be responsible for the testing of the backfill compaction. The testing shall be performed by an independent testing laboratory. Density tests shall be taken on each 12" layer at intervals not to exceed 300 lf. and at each transverse section of pipeline.

- (5) Pipe laying shall be done only after a careful inspection of each piece has been conducted and defective pipe discarded and replaced immediately. The pipe grade may be established by use of laser beam equipment, or by use of batter boards placed at not greater than 25' intervals.

The laying of pipe shall commence at the lowest point, with the spigot ends pointed in the direction of flow and proceed upward in gradient with the ends abutting and true to line and grade.

Under no circumstances shall pipe be laid in water, and no pipe shall be laid when the trench conditions or weather is unsuitable for working in dry conditions. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substance can enter the pipe. Any trench dewatering (well point, etc.) required for proper alignment of pipe shall be done by the contractor at his own expense, and no pipe shall be laid in the dewatering trench until approval is made by the engineer.

Openings such as stubs, wyes, tees, or other services along the lines shall be securely closed by means of an approved stopper that fits into the bell of the pipe and is recommended by the pipe manufacturer. This stopper shall be jointed in such a manner that it may be removed at some future time without injury to the pipe itself. At the close of each day's work, and at other times when pipe is not being laid, the end of the pipe shall be temporarily closed with a close-fitting stopper approved by the engineer.

All necessary precautions shall be taken to prevent the entrance of mud, sand or other obstructing material into the pipelines. As the work progresses, the interior of the sewer shall be cleaned of all dirt, jointing material, and superfluous materials of every description. The contractor shall flush all sewer lines, constructed under this contract with clean water, prior to final inspection to assure complete removal of all debris and foreign material, and to the satisfaction of the engineer.

5.10 TESTING

- A) The contractor shall perform testing of all sanitary gravity sewers, as set forth in these standards and shall conduct said tests in the presence of representatives from the City and/or other authorized agencies with 48 hours advance notice provided.

- B) Sanitary sewers to be tested shall be within sections. Testing shall not proceed until all facilities are in place and concrete cured. All piping shall be thoroughly cleaned prior to testing to clear the lines of all foreign matter.
- C) The contractor will utilize low-pressure air testing in accordance with Uni-Bell PVC Pipe Association, UNI-B-6-90, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe", latest revisions.
- D) Should any test fail, necessary repairs shall be accomplished by the Contractor, and the test repeated until the established limits are satisfied. Any repairs shall be performed under the supervision of the City forces and by methods receiving prior approval by the City.
- E) If during final inspection the City has reason to doubt the integrity of the sewer lines due to infiltration or poor line alignment, the City may require internal inspection (televising) of the sewer lines at the expense of the developer.
- F) All sanitary gravity sewer lines shall be televised (if requested) and lamped at the expense of the Owner/Contractor. In the event that the televising of the lines reveals problems (i.e. bellies, lateral deflection, etc), it may also be necessary, at the discretion of the City, to require an approved 9-arm deflection mandrel to be pulled through the sewer to ensure that the line is within acceptable slopes and deflection does not exceed 5% of the average inside diameter, as established by ASTM standards. Any pipe found to be out of compliance with these specifications, or not meeting the requirements of the City is to be removed and replaced at the expense of the Owner/Contractor.
- G) All tests shall be made by the contractor who shall provide necessary equipment for testing and lamping the system in the presence of and under the supervision and instruction of the engineer or his designee. All costs for testing defined below shall be borne by the contractor. Deflection testing shall be carried out under the observation of the Utility Department using a Go-No-Go device approved by the Utility Department and furnished by the Contractor. The deflection testing shall be performed at least thirty (30) days after final backfill of the trench. The maximum allowable vertical deflection of the cross section of the pipe will be five percent (5%) of the actual internal pipe diameter. If the results show the deflection of any sewer to be in excess of allowable, then the Contractor shall make repairs by re-excavation and compaction or replacement prior to acceptance.
- H) If, in the opinion of the engineer, infiltration appears excessive, the amount of leakage shall be measured by a suitable weir, as directed by the engineer, at the contractor's expense. When the infiltration exceeds the specified amount, correction shall be made to the satisfaction of the engineer. When infiltration is demonstrated to be within the allowable limits, the contractor shall remove such weirs.
- I) Following completion of the backfill cover, the complete sewer line shall be tested utilizing a low-pressure air test. All test requirements and procedures shall be in strict accordance with uni-bell PVC pipe association UNI-B-6-90 "recommended practice for

low-pressure air testing of installed sewer pipe”. The contractor shall furnish suitable temporary testing plugs or caps, pressure gauges, air pumps, etc. and any other necessary equipment and all labor required, without additional compensation. The engineer shall calculate the minimum time required for each test on each section of line and shall so advise the contractor prior to the test. If the section of pipe fails to pass the tests, the contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section) and repair or replace the defective pipe fitting, joint or other appurtenance, and retest the repaired section without additional compensation. Upon satisfactory completion of the tests, the contractor shall remove all temporary test plugs or caps and other equipment and shall restore the pipe to a condition ready for service. All tests shall be performed in the presence of an authorized representative of the engineer.

- J) All sanitary sewer air testing shall be completed a minimum of 30 days prior to the project substantial completion date.
- K) The contractor is advised that the owner reserves the right to use whatever additional inspection and testing methods it deems appropriate to verify the condition and acceptability of the work. The contractor shall repair all defects in the work made apparent by any and all inspections and tests, even if the work or parts of the work may have passed other tests and inspections.

SECTION 6

SANITARY SEWAGE FORCE MAIN

- 6.1 GENERAL

- 6.2 DESIGN STANDARDS
 - 6.21 Reference
 - 6.22 Operational Cost Considerations

- 6.3 STANDARD REQUIREMENTS
 - 6.31 General
 - 6.32 Joint Restraining
 - 6.33 Pipe Depth and Protection
 - 6.34 Air and Vacuum Venting
 - 6.35 Branch Connections
 - 6.36 Clean Out Connections
 - 6.37 Terminal Discharge
 - 6.38 Identification

- 6.4 TESTING

SECTION 6

SANITARY SEWAGE FORCE MAIN

6.1 GENERAL

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

6.2 DESIGN STANDARDS

6.21 Reference

The Developer shall comply with the applicable criteria set forth in the Recommended Standards for Wastewater Facilities, Latest Edition, and the Department of Environmental Protection requirements. Additionally, ASCE publication Pipeline Design for Water and Wastewater may be used as a design guide, if not in conflict with other requirements.

6.22 Operational Cost Considerations

In addition to initial capital expenditure, long term pumping station operational costs shall also receive consideration when sizing force main systems or making decisions concerning whether gravity service or lift station service is to be provided.

6.3 STANDARD REQUIREMENTS

6.31 General

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

6.32 Joint Restraining

Restrained joint assemblies with mechanical joint pipe shall be Mechanical Joint Retainer Gland, "locked-type" joints of EBBA Megalug Series 1100, Tyler Series 100, Tuff Grip, or approved equal restrained joints shall be provided at all bends, wyes, tees, caps, valves, and reducers. If any joints are within the required restrained length they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the plans or according to the pipe manufacturer's recommendations when not shown on the plans.

6.33 Pipe Depth and Protection

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

6.34 Air and Vacuum Venting

Where the force main profile is such that air pockets or entrapment could occur resulting in flow blockage, provisions for automatic air release and/or venting shall be provided. Where free flow will occur during operation or after pumping stops, combined air release and vacuum valve assemblies shall be provided. Air release valve shall be Valmatic ARV 48A, Valmatic ARV 801A or approved equal.

6.35 Branch Connections

Branch connections are not allowable. All force mains must terminate at manholes, wetwells, or force mains. Force mains shall not terminate into gravity sewers.

6.36 Clean Out Connections

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

6.37 Terminal Discharge

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

6.38 Identification

In order to preclude possible domestic water tapping, all installed underground sanitary sewage force mains shall be green (PVC) or ductile iron pipe marked with a continuous green stripe located within the top 90 degrees of the pipe.

6.4 TESTING

- A) The Contractor shall perform hydrostatic testing of all sanitary sewage force mains, as set forth in the following, and shall conduct said tests in the presence of representatives from the City and/or other authorized agencies with 48 hours advance notice provided.
- B) Piping and appurtenances to be tested shall be within sections between valves or adequate plugs, not exceeding 2000 feet with prior approval from the City. Testing shall not proceed until restraining devices are installed. All piping shall be thoroughly cleaned

and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

- C) Hydrostatic testing shall be performed at 150 pounds per square inch pressure, unless otherwise approved by the City, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable AWWA provisions for PVC-AWWA Publication M-23 and for DIP-AWWA Standard C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

<u>PVC</u>	—	<u>DIP</u>	
$L = \frac{ND P^{1/2}}{7400}$		$L = \frac{SDP^{1/2}}{133,200}$	

For 150 psi; test: L = 0.00165 ND (PVC)

For 150 psi; test: L = 0.000092 SD (DIP)

L = allowable leakage in gallons per hour

N= number of joints in section tested

S = length of pipe tested, in feet

D = nominal diameter of the pipe in inches

- 1) The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.
- 2) Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until within the established limits. The contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required sanitary sewage force main testing and shall perform the necessary system repairs required to comply with the specified hydrostatic test.
- 3) Pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi for a duration of 2 hours by means of a pump.

- D) All tapping saddles/valves shall be subject to a one hour pressure test at 150 psi with no allowable leakage.

SECTION 7

SEWAGE PUMPING STATIONS

7.1 GENERAL

7.2 DESIGN STANDARDS

7.20 Reference

7.21 Design Flows

7.22 Pump Selection

7.23 Sewage Pumps, Motors, and Standby Generators

7.24 Valves

SECTION 7

SEWAGE PUMPING STATIONS

7.1 GENERAL

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

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

7.2 DESIGN STANDARDS

7.20 Reference

The Developer shall comply with the applicable regulations established by the Florida Department of Environmental Protection. Additionally, the criteria provided in the Recommended Standards for Wastewater Facilities, Latest Edition may generally be utilized as design guidelines, if not in conflict with state, county, city, or other regulatory agency requirements. See typical City of Wildwood submersible lift station design drawing attached.

7.21 Design Flows

Sewage pumping stations shall be designed for the total ultimate development flow from all contributory areas.

7.22 Emergency Power Provisions - Generators and Emergency Power Connections

Standard generator plugs shall be as follows:

All 240 V, 3PH plugs shall be Russell Stoll Model #JRS2044FR All 480 V, 3PH plugs shall be Russell Stoll Model #JRS2044MR All 240 V, 1PH plugs shall be Russell Stoll Model #JRS1044FR

7.23 Sewage Pumps, Motors, and Standby Generators

- A) Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation. See attached drawing. Pumps shall be as manufactured by Flygt.
- B) Pump Motors

Pump motors should be non-overloading, excluding service factor, throughout the entire operating range of the pumps. Two or more normally closed heat sensing miniature switches connected in series and embedded within the motor windings shall be provided to shut off power and initiate alarm light for motor over-temperature condition.

C) Pump Controls & SCADA System

See Section 8 of these specifications for information on the Pump Control and SCADA control panel.

D) Submersible Pump Facilities

Installation shall include the removable pump units, aluminum access frame and cover, stainless steel pipe pump guide bars, pump discharge connection and other necessary appurtenances. The submersible pumping system and accessories shall be as manufactured by Flygt. See Detail Drawing for submersible lift station. Also provide a 4" camlock quick coupling for emergency by-pass at pumping stations.

E) Factory Built Facilities

Factory built facilities shall have prior City approval before inclusion in plans.

F) On-Site Standby Generator

See Section 9 of these specifications for information on Standby Generators for Lift Stations.

7.24 Valves

A) Valve Vaults

Valve vaults must be a minimum of 6 feet by 6 feet (inside dimension), with no less than 12 inches from the side wall to the valve clearance. Vault must be coated, with an epoxy coating inside and outside with a finish coat of 32 mils. All metal on the inside of the valve vault shall be coated with an epoxy coating and will also have a finish coat of 32 mils. See attached drawing.

B) Valves

All valves used in station valve boxes shall be DeZurik, 100% full flow plug valves, Mueller gate valves, or approved equal. Any valve 8 inches or over must be gear operated.

7.25 Residential/Single Commercial Grinder Pump Stations

A) Minimum Standards

Each applicant shall provide, construct, operate, and maintain a sewage grinder pump system of a type and size acceptable to the City of Wildwood. The grinder pump system shall be suitable for delivery of sewage into the City's sewer system. Grinder pump systems shall be in compliance with the requirements more particularly described below. Grinder pump system and all appurtenances shall be located within the property to be provided service. Grinder pump system shall include a discharge line of suitable size (Minimum 1.5") from the grinder pump station to the point of connection to the City's sewer system at the property line. The City will not operate or maintain the privately-owned lift station or the discharge line to the City connection point.

B) Single Residential Services

Minimum of one 1 horse power (hp) pump capable of introducing into the City's sewer system ten (10) gallons per minute of properly ground waste at a total dynamic head of ninety-two (92) feet or higher. Minimum tank volume of one hundred fifteen (115) gallons.

C) Single Commercial Services

Minimum of two 2 hp pumps capable of introducing into the City's sewer system with each pump ten (10) gallons per minute of properly ground waste at a total dynamic head of ninety-two (92) feet or higher. Minimum tank volume of three hundred seventy (370) gallons. Pumping requirements for horsepower, pumping rate and tank volume shall be determined by certified engineer or manufacturer representative for each specific installation.

D) Multiple Use Commercial Services

Any Commercial service with an engineered designed pumping capacity greeter than thirty (30) gallons per minute shall be constructed to the City of Wildwood standard construction specification for water and wastewater sheet detail S-16 (Typical Lift Station Layout) detail page 1-8.

SECTION 8

SEWAGE PUMPING STATION RTU AND PUMP CONTROL PANEL

8.1 GENERAL

- 8.14 PLC
- 8.15 Lift Station Power Equipment (Combo Panel)
- 8.16 Local Alarm System
- 8.17 Submersible Level Transducer
- 8.18 Field Service
- 8.19 Spare Parts

8.2 DRAWINGS

- 8.21 Shop Drawing Submittals
- 8.22 As-built Drawings and Instruction Manuals

8.3 GUARANTEE

8.4 SCOPE

SECTION 8

SEWAGE PUMPING STATION RTU AND PUMP CONTROL PANEL

8.1 GENERAL

- 8.11 It is the intention that this specification shall cover a complete Lift Station RTU and Pump Control Panel to add on to the existing VTSCADA Telemetry System as hereinafter described and all necessary appurtenances, which might normally be considered a part of the complete electrical system for this installation. Approved combination pump control panels shall be Barneys Pumps by Unitron Controls, Smart Energy Solutions by TPC, or approved equal. Panels shall be factory assembled, wired and tested, installed and covered by complete electrical drawings and instructions.
- 8.12 The intent of this specification is to assure that the Control System (VTSCADA) and panel are uniform standardized equipment. Where specific manufacturers are designated, substitutions will not be accepted. The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired. Unless the bidder clearly indicates in his bid that he is offering an equal product approved by the engineer via a pre-bid submittal, his bid shall be considered as providing the brand name product referenced in the specifications above.
- 8.13 The City of Wildwood utilizes a combination lift station pump control panel and Scada RTU to monitor and control all city lift stations. All combo panels contain a Scada PLC and display. The Panel shall be complete and Factory tested with the following accessories Panel, backup redundant float systems, liquid level transducer, and programming/startup.

A. Programmable Logic Controller

The PLC will be provided with configurable dynamic I/O to match any existing register mapping to match programming in the field or HMI system.

Interface to the PLC will be by 2 line display and keypad. Sample screens will be provided to the City of Wildwood for approval.

Text messaging will be the primary means of communication.

1. The PLC shall contain ten (10) 24Vac input signals received from devices such as pushbuttons, selector switches, pressure switches, temperature switches, or limit switches and converts them into voltage logic levels that can be processed by the controller. Six (6), relay outputs switched, 120Vac output signals that can drive loads up to 1 amp such as relays, starters, and solenoid valves. Two (2) analog inputs shall accept 4-20mA DC signals. Input shall be set for Unipolar with

Offset and Extended Resolution mode to detect loss of signal or low input indication. Resolution shall be 11 bit plus sign with a 10 ms conversion time.

2. Operation of the PLC processor shall be continuously monitored, and in the event the controller should stop functioning, or the branch circuit breaker is opened, an alarm from the Scitext Plus or approved equal will be generated. If the level rises to the backup floats the pumps shall run as required

B. PLC Ladder Logic Software

1. The System Integrator shall program PLC to perform, and warrant proper system operation as described in this document.
2. The Owner shall be sole owner of all programming software described in this contract; the use of any proprietary software other than described in this contract will not be accepted.
3. All points used in Ladder logic shall be documented and labeled so Owners personnel can identify each point and its function.
4. Control (Command) points shall be programmed such that control can be performed from HAND field devices (such as a selector switch) or from REMOTE by operator interface or MMI SCADA system, as described in contract. In some applications this will require that OR logic is in the program. The control description shall include how the MMI software should handle the commands.
5. Programmer shall keep the amount of points needed to control equipment to a minimum; project is licensed to a limited amount of MMI points to be used.

8.14 Approved PLC's are SCI-TROL by Unitron Controls 321-229-7643 and Allen Bradely by Smart Energy Solutions 321-229-7643.

Modification to the existing SciText Plus SCADA system Master RTU (PLC) and Central HMI Computer system to include all software revisions and additions to include all Remote Telemetry Unit (RTU) panel information as transmitted via Text messaging.

Modifications shall include the required engineering services to add the required HMI graphics and displays, reports, communications, historical data base and any other software function required to successfully integrate to information provided by the addition of the new facilities Remote Telemetry Units (RTU).

- A. ENCLOSURES: All enclosures shall be NEMA Type 12/3R, stainless steel enclosures with drip shield, complete with the required removable white enameled inner panel and drip edge. Enclosures shall include a single, gasketed front door, full height hinges, locking hasp and 3-point door clamping hardware. All enclosures shall be wall mounted,

properly sized for the application and UL listed. All major components and sub-assemblies shall be identified as to function with laminated, engraved, bakelite nameplates, or similar approved means. All enclosures shall include the correctly sized corrosion inhibitor device required to protect the interior panel components

- B. COMMUNICATIONS EQUIPMENT: The integrated cellular text modem system supplied shall comply with all applicable FCC requirements.

8.15 LIFT STATION POWER EQUIPMENT (COMBO PANEL)

- A. The Contractor shall provide the required Lift Station power equipment required to interface electrically with the pumps and associated controls.

- B. MOTOR STARTERS & BREAKERS: A NEMA rated size __ starter shall be furnished for each of the __ hp pump motors. The motor starters shall be Square D Class 8536 and shall be furnished with an ambient compensated overload relay. Alternate motor starter manufactures will not be considered. Each starter shall be furnished with an inner door mounted overload reset and the required heater elements sized for proper protection of the motor.

1. A molded case motor circuit protector (MCP) shall be furnished for each motor circuit. The MCP shall have a magnetic trip only, providing short circuit protection, and shall be coordinated with the motor starter for proper motor protection

2. A main breaker and an emergency breaker shall be furnished to service as a manual transfer switch and main breaker protection. The two breakers shall be mechanically interlocked preventing simultaneous closure of both devices. The main breaker shall be connected to the utility power accepting power from the remote service entrance disconnect.

3. The emergency breaker shall be wired to a generator receptacle mounted on the side of the enclosure. The receptacle shall be the JRS series as manufactured by Russel Stoll. The control manufacture shall coordinated with the Owner to insure the receptacle will properly mate with the City's generator plug.

- C. PHASE FAILURE RELAY: A phase-loss/unbalance/reversal and under-voltage protection assembly with adjustable nominal voltage setting shall be provided with three extractor type line voltage fuses. This device shall automatically lockout pump operation if all phases drop below 90% or if one phase drops below 80-83% nominal voltage. This device shall have a nominal 1/2 second dropout delay.

- D. SELECTOR SWITCHES, PUSH BUTTONS & LIGHTS shall be furnished in accordance with the individual Lift Station requirements.

1. An Operator's door mounted, 1-3/16" diameter, "hand-off-auto" 3 position, rotary, oil-tight, heavy-duty type selector switch shall be furnished for each pump. Each switch shall have an extra contact for input to the telemetry.
 2. An Operator's door mounted, 1-3/16" diameter, oil-tight, push button shall be furnished for each of RTU Control Panel component test functions.
 3. An operator's door mounted, 1" diameter, oil tight pilot light with bulb shall be provided for each of the following conditions:
 - Pump running (2)
 - Pump overtemp (2)
 - Pump seal leakage (2)
- E. PUMP RUNNING TIME METERS: An operator's door mounted, 120 VAC powered running time meter measuring hours and tenths of hours of operation up to 99999.9 hours shall be furnished for each pump motor indicated.
- F. PUMP OVER TEMPERATURE PROTECTION: Over-temperature protection shall be provided in the control panel to operate in conjunction with the over-temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a yellow failure indicating light and reset pushbutton on the inner panel for each pump for alarm indication and manual reset capability.
- G. PUMP SEAL FAILURE ALARM: A seal leak relay shall be furnished for each pump to sense a seal leakage condition. The control manufacture shall coordinate the relay furnished with the pump manufacture to insure compatibility. A door mounted pilot light and seal leakage sensor shall be provided to indicate a pump seal failure alarm condition of each sewage pump.
- H. REDUNDANT (BACKUP) LEVEL CONTROL: An independent high level alarm and redundant (backup) pump control capability with features as hereinafter listed shall be provided in addition to the specified primary level control system. It shall be powered by a 120 vac circuit breaker.
1. The independent alarm/control panel equipment shall be designed to UL508 Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the level sensing float circuits and dedicated redundant (backup) level control circuit.
 2. The front face of the RTU control panel shall be accessible through an operator's swing out door and shall incorporate the previously specified red indicator lights and push buttons.

3. The following outlines the level function indicator lights and push buttons required for the redundant (backup) Lift Station wet well level controls:
 - a. High Level Float and Test
 - b. Low Level Float and Test
4. An Operator energized panel mounted Test pushbutton shall be included with each of the float indicator lights for the purpose of test the indicate light and redundant (back up) control circuits.
5. An alternator relay shall be included for the purpose of alternating Lift Station Pumps 1 and 2 in conjunction with the redundant (backup) float switch operation.
6. The redundant (backup) level control shall operate in conjunction with the required direct-acting float switches. The backup float switch system shall be mounted in the Lift Station wet well at the elevations required to ensure lift station pump control when the primary level controls fail for any reason (i.e. primary level transmitter fails, primary level controller fails, primary level relay fails, etc.) The Float system shall be 24Vac.
7. The float switch shall be mounted in the Lift Station wet well pit in accordance with the manufacturer's instructions or as shown on the plans.
8. The High Level float shall energize a high level relay and indicator light providing the Operator a level alarm status. This High Level status shall also energize the panel mounted Local Alarm System horn, strobe alarm light and shall record this alarm condition at the Microprocessor Controller/Telemetry Unit (MCT). The Operator must acknowledge this alarm condition to silence the horn.
9. The LEAD On float shall energize the lead on relay and indicator light. This level condition shall activate the Redundant (Backup) Level Controls and shall start the lead pump as designated by the alternator relay. This Lead On level status shall be recorded as an alarm condition at the Microprocessor Controller/Telemetry Unit (MCT).
10. The Redundant (Backup) Level Controls shall continue to operator. The LAG pump shall start as designated by the alternator relay when the Lag On float energizes the lag on relay and indicator light.
11. The Pump OFF float shall energize the pump off relay and indicator light, stopping all Lead and Lag pumps in operation.
12. The Low Level float shall energize a low-level relay and indicator light providing the Operator a level alarm status.

13. The Redundant (Backup) Control and Alarm capability shall be completely integrated in the specified RTU control panel and system as described and in accordance with all applicable codes and job requirements.
14. Each liquid level sensing float switch shall have a 4½” diameter molded polypropylene body, potted switch/cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run un-spliced to the RTU Control Panel or junction box, as required.
15. The Contractor shall furnish, install and wire the float switches as shown on the drawings. Each float switch shall be internally weighted and be individually suspended in the wet well. The float switch cables shall be suspended from a cable rack mounted to the top slab of the Lift Station wet well.

8.16 LOCAL ALARM SYSTEM

- A. The alarm light shall be a weatherproof strobe operating on 12 VDC, producing a 500,000 candlepower flash through a high-impact red lexan lens operating at 60 to 90 flashes per minute.
- B. The light shall be surface mounted on the top of the pump station control cabinet, through a cutout in the sun shield and be very noticeable both night and day.
- C. The horn and strobe light shall be energized on a high level alarm condition.

8.17 SUBMERSIBLE LEVEL TRANSDUCER

- A. The liquid level at the Lift Station shall be sensed by maintenance free level indicator with a 4-20 mA signal representing level/pressure.
- B. The submersible liquid level transducer system shall be a birdcage type and approved equals by the City.

8.18 FIELD SERVICE

- A. On-site Supervision: The System Supplier shall provide experienced personnel to supervise, perform, and coordinate the adjustment, testing, and startup of the SCADA panel. The personnel shall be present on-site (1) day to effect a complete and operating system.

8.19 SPARE PARTS

- A. Spare parts as specified shall be included with each panel provided. Parts shall include but not limited to 1062 controller, relays, and a texting modem.

8.2 DRAWINGS

- 8.21 Shop Drawing Submittals Shop Drawings shall be submitted for approval for all equipment herein specified. All project drawings shall be generated using AutoCAD, latest revision. The Shop Drawing Submittal shall include a Document List. An Order Specification shall be included which shall describe in detail all equipment provided. Each panel shall be provided with a job-specific wiring diagram, parts list (with all parts keyed to the wiring diagrams), enclosure door layout and enclosure dimension drawing. This requirement includes the MCC. Manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. A Description of Operation shall be provided detailing the operation of the complete system, including the various control loops, system power equipment and alarm handling.
- 8.22 As-built Drawings and Instruction Manuals Provide As-built Drawings and Instruction Manuals. These manuals shall include corrected Shop Drawings. In addition, a detailed Programming and Operations Manual for the Microprocessor-based Controller/Transceiver and Control and Monitoring software package shall be included.

8.3 GUARANTEE

All equipment shall be guaranteed against defects in material and workmanship for a period of not less than one year from date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

8.4 SCOPE

Furnish all instrumentation and control systems hereinafter specified to perform the intended function. Work shall include all labor, materials and equipment, performance of all work necessary to complete the manufacture, to make factory tests, to prepare and load for shipment, to deliver to the site, to provide programming, calibration, installation supervision, system start-up, services and incidentals required to completely furnish a functional system.

SECTION 9

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SECTION 9

STANDBY DIESEL ENGINE DRIVEN GENERATOR WITH WEATHERPROOF ENCLOSURE

9.1 GENERAL

9.11 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install, put into operation, and field test the weatherproof diesel engine driven generator unit and appurtenances as required by the City of Wildwood.
- 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 application. It is, however, intended to cover the furnishing, the shop testing, and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete 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. This installation shall incorporate the highest standards for the type of service shown on the Drawings. The CONTRACTOR is responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.
- D. All standby generator sets to be utilized in the City of Wildwood utility system shall conform to these specifications and shall be subject to approval of the Utilities Director.

9.12 DESCRIPTION OF SYSTEMS

- A. The engine-generator set shall be mounted as shown on the Drawings and shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power. The unit controls shall provide for automatic exercising on a weekly basis.

9.13 QUALIFICATIONS

- A. The engine-generator set shall be the UL2200 listed standard product, as modified by these specifications, of a MANUFACTURER regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a MANUFACTURER, the engine must be the principal item manufactured

and the completed engine generator set shall be supplied by the MANUFACTURER's authorized distributor only. The distributor shall have a minimum of ten (10) years experience in the field of power generation.

- B. It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the NEC, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the engine/generator and controls, transfer switch and switchgear, and assembles the emergency generator system as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.
- C. The unit must be of such physical dimensions as to make a good installation in the opinion of the Utilities Director, in the space provided as indicated on the Drawings.
- D. The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a MANUFACTURER currently engaged in the production of such equipment.
- E. The unit shall be shipped to the jobsite by an authorized engine dealer having a parts and service facility within a 75 mile radius of the jobsite. In addition, and in order not to penalize the OWNER for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than eighty percent (80%) of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the City upon submittal of construction plans.
- F. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein. Major exceptions to these Specifications will be considered sufficient cause for rejection of the machines.
- G. The Engine/Generator Unit shall be as manufactured by Cummins Power Generation, Caterpillar, or Onan.

9.14 SUBMITTALS

- A. Submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimensional drawings, and interconnection diagrams identifying by terminal number each required for

interconnection between the generator set, the transfer switch, and the switchgear panels included elsewhere in these specifications.

- B. The Developer shall submit to the Utilities Director for review in accordance with other sections, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, including foundation drawings showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment.
- C. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.
- D. The submittal data for each engine/generator set and weatherproof enclosure shall include, but not necessarily be limited to, the following:
 - 1. Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; weatherproof enclosure and base mounted fuel tank.
 - 2. Engine Data:
 - a. MANUFACTURER
 - b. MODEL
 - c. Number of cylinders
 - d. RPM
 - e. Bore x stroke
 - f. BMEP at full rated load
 - g. Piston speed, FPM
 - h. Make and model and descriptive literature of electric governor (where required)
 - I. Fuel consumption rate curves at various loads
 - j. Engine continuous pump drive duty rating (without fan) HP
 - k. Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads) HP
 - 3. Generator Data:
 - a. MANUFACTURER
 - b. Model
 - c. Rated KVA
 - d. Rated SKVA
 - e. Rated kw
 - f. Voltage
 - g. Temperature rise above 40 degree C ambient
 - 1) Stator by thermometer
 - 2) Field by resistance
 - 3) Class of insulation
 - h. Generator efficiency including excitation losses and at 80 percent power factor.
 - 1) Full load

- 2) 3/4 load
- 3) 1/2 Load
- 4. Generator Unit Control Data:
 - a. Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Standard preprinted sheets are not acceptable.
 - b. Legends for all devices on all diagrams.
 - c. Sequence of operation explanations for all portions of all schematic wiring diagrams.
- 5. Engine/Generator Unit and Weatherproof Enclosure: Dimensional data shall be given for the Engine/Generator set and for the weatherproof enclosure.
 - a. Weight of skid mounted unit
 - b. Overall length
 - c. Overall width
 - d. Overall height
 - e. Exhaust pipe size
 - f. CFM of air required for combustion and ventilation
 - g. Heat rejected to jacket water and lubricating oil BTU/hr.
 - h. Heat rejected to room by engine and generator BTU/hr.
 - i. Weatherproof enclosure details and certification of manufacturing method per specifications.
 - j. Base fuel tank, venting, fuel connection points and fill cap location.
 - k. Data on all miscellaneous items supplied.
- 6. Optional System Service Contract:
 - a. Equipment Supplier Company Name, Address, City/State, Phone Number
 - b. Attach the number of copies required of System Service Contract to submittal.
- 7. Furnish the number of copies required of the MANUFACTURER'S certified shop test record of the complete engine driven generator unit.
- 8. Warranty information.
- E. Submit to the Utilities Director operating and maintenance data.
- F. Submit to the Utilities Director the equipment MANUFACTURER'S Certificate of Installation, Testing, and Instruction.
- G. Submit to the Utilities Director the written warranty as required in Paragraph 3.06 below.

9.15 TESTING

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

- A. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following

tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

1. Maximum power (KW).
 2. Maximum motor starting (KVA) instantaneous voltage dip.
 3. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-2240 and 16.40.
 4. Governor speed regulation under steady-state and transient conditions.
 5. Voltage regulation and generator transient response.
 6. Fuel consumption at 1/4, 1/2, 3/4, and full load.
 7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 8. Three-phase short circuit tests.
 9. Alternator cooling air flow.
 10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
 11. Endurance testing.
- B. Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
1. Single-step load pickup.
 2. Transient and steady-state governing.
 3. Safety shutdown device testing.
 4. Voltage regulation.
 5. Rated power.
 6. Maximum power.
 7. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.
- C. Site Tests: An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The Utilities Director, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
1. Fuel, lubricating oil, an antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
 3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.
 4. Automatic start-up by means of simulated power outage to test remote- automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.

9.16 SPECIAL TOOLS AND SPARE PARTS

- A. The MANUFACTURER shall furnish two (2) complete spare replacement sets of all filter elements required for the generator unit.

9.2 PRODUCTS

9.21 RATINGS

- A. The standby rating of the generator set shall not exceed the MANUFACTURER's published prime rating by more than 10%. The gross engine horsepower required to produce the standby rating shall not exceed the MANUFACTURER's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS649 or DIN6270 but in no case shall it exceed the MANUFACTURER's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1800 rpm.
- B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the MANUFACTURER for the actual unit supplied.
- C. The Diesel Engine/Generator Unit shall be rated for 277/480 volts, 3-Phase, 60 Hertz at 0.8 power factor with fan. The engine/generator set shall be suitable for starting two (2) submersible pump motors sequentially with 5 KVA of miscellaneous load on line. Manufacturer shall certify this in writing. Obtaining a motor starting KVA for each pump motor is the responsibility of the Engineer.

9.22 ENGINES

- A. The engine shall be full compression ignition, four cycle, single acting, solid injection engines, either vertical or "V" type. Speed shall not exceed 1800 revolutions per minute at normal full load operation. Multi block engines are not allowed. The engine governor shall be electronic type with a +/- 0.5 percent accuracy.
- B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.
- C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.
- D. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, engine driven water pump, and unit mounted instruments. Unit mounted instruments shall include a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge. The engine shall be provided with low oil pressure, high water temperature, low coolant level and overspeed

safety shutdowns of the manual reset type. Additional instruments and safety shutdowns shall be provided as noted herein.

- E. Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by ordinary mechanics without special diesel experience. The engines shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.
- F. The fuel system shall be equipped with fuel filters having replaceable elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure.
- G. In addition to the standard fuel filters provided by the engine MANUFACTURER, there shall also be installed a primary fuel filter and a water separator in the fuel inlet line to the engine.
- H. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one piece stress relieved gray iron casting.
- I. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be accessible, easily removed and cleaned and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler.
- J. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit.
- K. During each initial start of the engine, a system shall be provided to pre-lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine will then increase to generator set operation speed.
- L. Mounting: The unit shall be mounted on a structural steel sub-base and shall be provided with spring type vibration isolators.

9.23 COOLING SYSTEMS

- A. The engine shall be furnished with a unit mounted radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 122 degrees F. The engine shall be

provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. Total air restriction from the radiator shall not exceed 0.5 inches of water at both inlet and outlet. A flexible connecting section shall be provided between the radiator and discharge louver frame.

- B. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine MANUFACTURER.
- C. Provide one (1) or two (2) unit mounted thermal circulation type water heaters incorporating a thermostatic switch shall be furnished to maintain engine jacket water at minimum of 70 degrees F. The heaters shall be 120 volt, single phase, 60 Hertz, size as required to achieve above noted ambient.
- D. The expansion tank of the radiator shall be fitted with a low water level switch and wired into the safety shutdown system of the unit.
- B. All fuel piping shall be installed in containment piping.

9.24 GENERATOR, EXCITER AND ACCESSORIES

- A. Rating: The generator shall be rated 0.8 p.f., 1800 RPM 3 phase, 60 Hertz, 277/480 volts, 4 leads, with a maximum temperature rise of 105 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The generator shall conform to NEMA Standard MG-1. The generator shall be oversized to allow starting 2 motors (Code letter to be provided by the Contractor) across the line, sequentially, with 5 KVA of miscellaneous load on line.
- B. Performance: The instantaneous voltage dip shall not exceed 20 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +1/2 percent.
- C. Construction:
 - 1. The generator and exciter shall be drip proof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.
 - 2. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.
 - 3. Generator stator and exciter stator windings shall be a full Class H insulated system vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be random or machine wound, and precision made, with turn-to-turn and ground insulation of glass yard and mica materials. The average di-electric strength for the form wound coils of the ground and end turn insulation shall not be less than 400 volts per mil. Spacers shall be tightly

secured between end turns, and the end turn assembly securely lashed to the support rings.

4. Generator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full line to ground fault currents, with solidly grounded neutral system.

D. Accessories and Attachments

1. Low Voltage Terminal Boxes: The generator shall have separate AC and DC low voltage terminal boxes with suitably numbered terminal strip for required connections.
2. All required P.T.'s, C.T.'s and protective relays shall be supplied by the engine-generator MANUFACTURER as required.
3. Space Heaters: Space heaters shall be installed on the generator frame to maintain temperature of the entire generator above the dew point while not in use. Power supply shall be 120 volts single phase. Heaters will be automatically disconnected when engine starts. The magnetic starter for the heaters shall be mounted in the terminal box. Furnishing and installation of control and starter to be by engine/generator supplier.

E. Generator Associated Controls:

1. Voltage Regulator:
 - a. The generator MANUFACTURER shall furnish a hermetically sealed, silicon controlled rectifier type voltage regulator employing a zener reference with a +1 percent regulation for the generator. The regulator shall include 3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. Switches and/or fuses shall not be used to provide this protection. An over-voltage sensing module with manual reset shall be furnished with the regulator. A volts per Hz., sensing module shall be provided as part of the regulation system.
 - b. A voltage adjustment rheostat for 5 percent voltage adjustment on the unit shall be provided.
 - c. High voltage step-down potential transformers shall be provided for the voltage regulator power input and sensing circuits if required.
2. Sustained Short Circuit: A permanent magnetic exciter shall be provided on the unit for sustaining a current of 300 percent during a short circuit, permitting the generator breaker to trip on overload. To prevent possible overheating of the armature windings, appropriate relaying shall be supplied to limit the fault to ten seconds. All current transformers required shall be supplied by the switchgear MANUFACTURER.

9.25 WEATHER-PROTECTIVE ENCLOSURE

- A. The intent of this Specification is to provide the City of Wildwood with a weatherproof sound attenuated generator set enclosure complete in every detail and requiring no additional in-field modifications or assembly, except where specifically allowed by these Specifications. The enclosure is to be accurately dimensioned so as to be in compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) for clearance of all specified items included therein, and all applicable fire codes for a structure and application of this type.
- B. Construction drawings, engineering blueprints, or other bid documents accompanying these Specifications which show switchgear, transfer switch(es), motor controllers(s), and/or other service or distribution equipment within the generator set enclosure must be considered complimentary to and not in lieu of this written Specification. Drawings submitted for approval shall reflect this fact clearly and any contradiction or omission shall be brought to the attention of the Utilities Director.
- C. The enclosure shall be of sheet metal construction as designed and manufactured by the generator supplier. The design and construction shall be modular in that the side panels, doors, and louvers shall not exceed 36 inches in width and shall be a minimum thickness of 14 gauge for all component parts. The roof of the enclosure shall meet or exceed the minimum gauge requirements specified but, in addition, shall be strengthened in such a manner as to support the largest commercially available exhaust silencer recommended by the MANUFACTURER for this application.
 - 1. Construction - All sheet metal used in the construction shall be primed and painted. This sequence of metal forming, and final assembly of the enclosure must be noted on the drawings submitted for approval and a factory certification of this manufacturing process shall accompany the "as-built" drawings provided to the OWNER. Walls and roof shall be constructed of 14 gauge steel.
 - 2. Attenuation – The enclosure will be designed to provide a noise emission rating of 76 decibels at a distance of 23 feet from any point on the generator. Utilize plenum if necessary to meet this requirement.
 - 3. Doors - All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow good access to and visibility of instruments, controls, engine gauges, etc. The doors shall be fitted with bolt-on, stainless steel hinges constructed with stainless steel hinge pins of a diameter not less than 0.25-inch (1/4-inch). Each door shall be fitted with flush-mounted, adjustable, key-lock latches. Enclosure shall be rated for 110 MPH constant wind. Certified calculations shall be provided.
 - 4. Louvers - All louvers fixed and drainable with bird screen and shall be designed to the total engine/generator cooling air requirements used in this application. Maximum air velocity shall be 700 CFM. MANUFACTURER shall submit air flow calculations to engineer for review.
 - 5. Components All components of the enclosure shall be assembled utilizing 0.375-inch minimum stainless steel bolts, nuts, and lock washers. In addition, watertight neoprene flat washers shall be used on all roof bolts.
 - 6. The MANUFACTURER of the enclosure shall provide mounting brackets for the exhaust silencer specified. In addition, a tail pipe extension terminating in a horizontal plane and cut at a 45° angle to prevent the stainless steel, seamless flexible exhaust tube and all necessary bolts, flanges, and gaskets to mate with the

engine and the exhaust silencer shall be provided. The length of the flexible tubing shall be such that additional solid metal nipples or sections shall not be required to be provided as spacers between the engine exhaust port or the exhaust silencer.

7. All wiring to the switchgear from the generator shall be in conduits made from Rigid Metal, IMC, or liquid-tight material specifically manufactured for electrical use. All connections at the generator set shall be flexible, and all shall be provided and installed by enclosure manufacturer.
8. Oil and Water Drains - All necessary fittings, hoses, shut-off valves, etc., shall be provided by the MANUFACTURER of the enclosure to facilitate lube oil and water drain at the exterior of the enclosure. In addition, engines equipped with crank-case breather tubes shall have this tube terminate at the exterior of the enclosure directly under the radiator air discharge louver.
9. Enclosure - The enclosure shall be skintight construction to meet specific project requirements.
10. Under no circumstances shall the floor area or any of its parts be considered for cooling air intake or discharge requirements of the generator set or its associated equipment, nor shall its properties as a "heat-sink" or heat dissipating medium be utilized in any manner whatsoever in this application.
11. All items specified herein shall be supplied and prewired and/or pre installed including, but not limited to the following:
 - a. Rain dress for exhaust pipe and tail pipe extension. Rain dress shall prevent the entrance of rain and allow for the expansion and vibration of the exhaust piping without stress to the exhaust system. Rain dress shall be stainless steel and provided by the enclosure supplier.
 - b. Coordination between CONTRACTOR and Supplier is mandatory and the equipment Supplier's instructions will be adhered to without exception.

9.26 FUEL SYSTEM

- A. Base and Mounting - The generator set and enclosure shall be mounted and shipped to the jobsite on the formed steel sub-base provided by generator supplier. Provisions for crane unloading of the complete package shall be designed into the base of the unit.
- B. The base and enclosure assembly allow room within the package to mount and maintain the specified battery charger, engine starting batteries, racks, and cables, main line circuit breaker, and engine-generator control panel, and other items as specified or as shown on the drawings.
- C. The weight of the entire unit consisting of generator set, base, enclosure, and all other specified items including all liquids (i.e., fuel oil, lube oil, and cooling water) shall be calculated by the MANUFACTURER. The base of the unit shall be designed and manufactured as a heavy duty, formed steel construction with four (4) point lifting provision to support the calculated weight. Details and MANUFACTURER's certification of the base construction shall be included with the drawings submitted for approval as well as all weight calculations.
- D. Base Tank (UL142) - The unit shall be equipped with a double wall in-base fuel tank and shall be supplied with a lockable, exterior located fill cap. The capacity (gallon) of the

base tank shall permit operation of the generator for 24 hours at 100 percent load. All necessary fuel and vent lines for proper engine performance shall be provided as well as a means to readily detect the fuel level in the tank without the use of a measuring stick.

- E. The fuel tank base dimensions shall be full size of the generator base and be formed from steel of a minimum metal thickness of 0.25-inch (1/4-inch) and shall be fitted with low fuel level and inner wall leak alarm contact for local and remote annunciation. The fuel tank height shall not exceed 30 inches.
- F. Filter/Separator-In addition to the standard fuel filters provided by the engine MANUFACTURER, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. The filter shall be a Fleetguard, Racor, simplex or duplex Model 1000, as required for proper fuel flow. It shall be supplied and installed by the enclosure supplier.

9.27 EXHAUST SYSTEM

- A. Exhaust Silencer - A critical type, side inlet, end outlet, Nelson, Maxim M-51, or Silex JB silencer and a flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the MANUFACTURER's recommendation. Mounting shall be provided by the CONTRACTOR as required. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine MANUFACTURER. So called "spiral" or truck mufflers are disallowed and will not be considered as equal to the industrial quality silencers specified above.
- B. The silencer shall be fitted with a tail pipe extension terminating at a 45° angle to prevent the entrance of rainwater. It shall also be fitted with an expanded metal bird screen.
- C. Rain Skirt - At the point where the exhaust pipe flexible tubing penetrates the roof of the enclosure, a suitable "rain skirt" and collar shall be provided by the MANUFACTURER. It shall be designed to prevent the entrance of rain and allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system. This detail must appear on the drawings submitted for approval.

9.28 AUTOMATIC STARTING SYSTEM

- A. Starting Motor - A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be 24 volts.
- B. Automatic Control - Fully automatic engine start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and loss of engine coolant. Alarms for approaching high water temperature and impending low oil pressure shall also be included. Controls shall include a 45-second single cranking cycle limit with lockout or a cyclic crank system with lockout and overcrank protection.
- C. Batteries - A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be 24 volts, and the battery set shall be rated no less than 225 ampere hours. Necessary cables and clamps shall be provided.

- D. Battery Tray - battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall be constructed of fiberglass and so treated as to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over of battery electrolyte shall be contained within the tray to prevent a direct path to ground.
- E. Battery Charger - A current-limiting, automatic 24 volt DC charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than ten (10) amperes. Charger shall be wall mounting type in NEMA 1 enclosure, and U.L. listed as an industrial control panel. The charger shall be as manufactured by LaMarche per NFPA 110 and U.L. 508. The charger shall be mounted and wired within the enclosure for the generator set by enclosure manufacturer.

9.29 MAIN LINE CIRCUIT BREAKER

- A. Type - Main line, molded case circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The breaker shall include ground fault sensing that will trip the breaker on ground fault conditions.
- B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electrical Code.
- C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.
- D. Circuit breaker shall have battery voltage operated shunt trip wired to safety shutdowns to open the breaker in the event of engine failure.
- E. Each circuit breaker shall be equipped with an auxiliary contact for remote annunciation of breaker position.
- F. The rating of each circuit breaker shall allow the starting of full generator SKVA.
- G. The circuit breaker enclosure, together with all specified circuit breakers, shall be designed for the specific generator set specified and be equipped with an isolated neutral conductor bus, rear copper stabs, or load cable lugs and be finish painted to match the generator set.

9.30 GENERATOR CONTROL PANEL

The generator set shall be provided with a microprocessor-based control system (tied into the City's VTSCADA system) that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be

vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
2. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
3. The control system shall log total number of operating hours, total kWh, and total control on hours, as well as total values since reset.

C. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
2. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown).
3. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at

the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

4. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
5. The control shall include an amber common warning indication lamp.
6. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
 - a. low oil pressure (alarm)
 - b. low oil pressure (shutdown)
 - c. oil pressure sender failure (alarm)
 - d. low coolant temperature (alarm)
 - e. high coolant temperature (alarm)
 - d. high coolant temperature (shutdown)
 - f. high oil temperature (warning)
 - g. engine temperature sender failure (alarm)
 - h. low coolant level (alarm or shutdown--selectable)
 - i. fail to crank (shutdown)
 - j. fail to start/overcrank (shutdown)
 - k. overspeed (shutdown)
 - l. low DC voltage (alarm)
 - m. high DC voltage (alarm)
 - n. weak battery (alarm)
 - o. low fuel-daytank (alarm)
 - p. high AC voltage (shutdown)
 - q. low AC voltage (shutdown)
 - r. under frequency (shutdown)
 - s. over current (warning)
 - t. over current (shutdown)
 - u. short circuit (shutdown)
 - v. over load (alarm)
 - w. emergency stop (shutdown)
7. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
8. The control shutdown fault conditions shall be configurable for fault bypass.

D. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control: engine oil pressure (psi or kPA), engine coolant temperature (degrees F or C) engine oil temperature (degrees F or C) engine speed (rpm), number of hours of operation (hours) number of start attempts battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
2. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor

the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

3. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
4. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

G. Other Control Functions

1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network.
2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

H. Control Interfaces for Remote Monitoring:

1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
2. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
3. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

9.31 AUTOMATIC LOAD TRANSFER SWITCH

- A. The rating of the automatic load transfer switch (ATS) shall be sized to the station main breaker rating. The ATS shall be service entrance rated if required by the NEC.

- B. The automatic transfer switch shall be mechanically held on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure. The switch shall be solid-state, electronically controlled, double throw with the main contacts rigidly and mechanically interlocked to ensure positive positioning of power switches. A manual operator must be provided to enable one (1) hand manual operation which, when utilized, can provide a neutral position for servicing operations.
- C. The automatic transfer switch shall be a single motor operated circuit breaker type with interpole barriers and arc chutes. So-called linear actuated or solenoid operated switches are approved only when manufactured by the Generator MANUFACTURER. All elements of the drive system must be replaceable from the front of the switch, and the power switching devices must be replaceable without removal of the connecting cables.
- D. The transfer switch shall be listed under U.L. 1008, in NEMA 4X stainless steel enclosure, as manufactured by Cummins, Onan, CAT, or approved equal.
- E. Accessories - The automatic load transfer switch specified shall include the following accessories:
 1. Full phase protection. Solid-state phase monitor shall be field adjustable, close differential type, with 85-100% pick-up and 75-98% drop-out. A single adjustment shall set all phases.
 2. Solid-state voltage and frequency monitor on generator output to prevent transfer prior to proper output parameters, adjustable 85-100% of generator rated voltage and frequency, with adjustable drop-out of 75-85% of pick-up setting.
 3. Adjustable, solid-state, 0.5 to 6 seconds time delay on engine starting to override momentary outages and nuisance voltage dips.
 4. Adjustable, solid-state, 2 to 30 minutes time delay on retransfer of load to normal.
 5. Adjustable, solid-state, 2 to 30 minutes cool-down timer wherein the generator set runs unloaded after retransfer to line.
 6. Motor load decay time delay, pneumatic type, adjustable for 1.5 to 15 seconds and operating on transfer to either source.
 7. Adjustable, solid-state, 0.5 seconds to 5 minutes time delay on transfer to emergency source after verification of emergency source voltage and frequency.
 8. Test switch to simulate normal power failure, heavy duty, oil tight, pushbutton type with momentary contacts and override circuitry to revert to normal power if emergency source should fail during test.
 9. Motor circuit disconnect switch.
 10. Three (3) pilot lights, to indicate the normal and emergency position of the transfer switch, and mode selector switch in "off" position.
 11. Engine starting contacts to provide for generator starting from each unit independent of the other.
 12. One (1) auxiliary S.P.D.T. contact on emergency breaker and one (1) S.P.D.T. auxiliary contact on normal breaker.
 13. Plant exerciser to start and run the generator set with or without load (in-field switchable) each 168 hours for a 30 minute interval.

14. Four (4) position mode selector switch marked "test", "auto", "off", and "engine start".
15. Equipment grounding lug.
16. Cable connection lugs, cu/al type for all conductors.
17. The ATS shall be either solid neutral or switched neutral design as required by the City.

9.4 EXECUTION

9.41 SERVICES

- A. Furnish the services of a competent and experienced MANUFACTURER'S field service technician who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than two (2) days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.
- B. At least one (1) of the two (2) days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the OWNER and shall take place during plant start-up and acceptance by the OWNER.
- C. Three final copies of operation and maintenance manuals specified must be delivered to the Owner prior to scheduling the instruction period.

9.42 PAINTING

- A. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the MANUFACTURER's standard practice prior to shipment. An adequate supply of touch-up paint shall be supplied by the MANUFACTURER.

9.43 TESTING

- A. The engine-generator set shall be given the MANUFACTURER'S standard factory load test prior to shipment.
- B. Prior to final acceptance of the generator set, all equipment furnished under this Section shall be field tested per NFPA 110 to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks (brine tanks not acceptable). Test shall be for four (4) continuous hours. Any defects which become evident at this time shall be corrected before acceptance.
- C. An all-in-place static alignment check of all rotating components shall be made prior to first start-up, after unit is secured in place and all final connections are made.

9.44 SYSTEM SERVICE CONTRACT

- A. The supplier of the standby power system must provide a copy of and make available to the OWNER his standard service contract which, at the OWNER'S option, may be accepted or refused. This contract will accompany documents, drawings, catalog cuts, specification sheets, wiring or outline drawings, etc., submitted for approval to the utilities Director. The contract shall be for the complete services rendered over a period of one (1) year.

9.45 WARRANTY

- A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the MANUFACTURER'S and dealer's warranty. But, in no event, shall it be for a period of less than two (2) years (comprehensive) from date of initial start-up of the system and shall include labor, parts and travel time for necessary repairs at the job site. Running hours shall not be a limiting factor for the system warranty either by the MANUFACTURER or the supplying dealer. Submittal data received without written warranties as specified will be rejected in their entirety.

SECTION 10

WATER DISTRIBUTION SYSTEM

10.1 GENERAL

10.2 DESIGN STANDARDS

10.21 Reference

10.22 System Size Computation

10.3 STANDARD REQUIREMENTS

10.31 General

10.32 Fire Hydrants

10.33 Joint Restraining

10.34 Connections at Structure

10.35 Special Exterior Protection for Corrosion

10.36 Air Venting and Blow Offs

10.37 Service Connections

10.4 TESTING

10.5 DISINFECTING

SECTION 10

WATER DISTRIBUTION SYSTEMS

10.1 GENERAL

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

10.2 DESIGN STANDARDS

10.21 Reference

Normal flow demands for design shall be calculated on the basis of full ultimate development as known, or projected. Flow demands for commercial, industrial or other special developments shall be established from existing records or by estimated projections, using the best available data. It shall be stated in the Developers Agreement that the Developer shall bear sole responsibility for sizing the water system improvements to meet the projected demand for the Development. Any future onsite upsizing of utilities required due to more intensive uses of the land shall be the responsibility of the Developer. Water main installations shall generally be in accordance with the Recommended Standards for Water Works, Latest Edition.

10.22 System Size Computation

The allowable minimum service pressure under said design condition shall not be less than 20 pounds per square inch. Design computation shall be by the "Hardy Cross" procedure, or other applicable methods, as dictated by the system configuration.

Design flows and method of computation shall be subject to review and approval by the City.

10.3 STANDARD REQUIREMENTS

10.31 General

The materials of construction and general installation procedures, with the exception of fire hydrants, shall comply with the specific applicable standards set forth under Section 2, "Utility Excavation, Trenching and Backfilling", Section 3, "Boring and Jacking", and Section 4, "Pipe,

Fittings, Valves and Appurtenances", as well as "Standard Details-Water Distribution Systems".

10.32 Fire Hydrants

Hydrants shall comply with AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Service", and shall be equipped with a minimum of one (1) pumper outlet nozzle 4 ½ inches in diameter and two (2) hose nozzles 2 ½ inches in diameter. Threads, nozzle caps, operating nuts and color shall conform to City Standards. Units shall be traffic type with breakable safety clips or flange, and stem with safety coupling located below barrel break line to preclude valve opening.

Hydrants shall be dry top type. Outlet nozzles shall be on the same plane, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5 1/4 inches minimum opening unless otherwise requested and show inlet connection to be 6 inches minimum.

- A) Hydrants shall be installed plumb and in true alignment with the connection pipes to the water main. They shall be securely restrained. The gravel or crushed stone for the drain sump, followed by backfilling, shall be carefully placed and compacted. Installed hydrants shall be painted yellow for city use and red for private use. Hydrants shall be tested and flowed prior to placing into service and bonnet color coded for pressure/flow as required by Sumter County Fire Department.
- B) Hydrant placement is to be a minimum of 6 foot and a maximum of 9 foot from the curb or paved road surface unless otherwise approved. The center of the steamer port shall be 18 inches minimum and 24 inches maximum above final grade. Steamer port shall be correctly positioned for the proper connection, with the approval of the City (Water & Fire Department).
- C) All fire hydrants shall be equipped with a GradLock fitting for adjustment of the hydrant elevation.

10.33 Joint Restraining

Mega-Lug, or "EJ Tuff Grip" restrained joints shall be provided at all points where the line bends greater than 10 degrees and at all wyes, tees, caps, valves, hydrants and reducers. If any joints are within the required restrained length they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the plans or according to the pipe manufacturer's recommendations when not shown on the plans. Any points with a depth greater than 7 ft. and where the line bends greater than 10 degrees and at all wyes, tees, elbows, caps, valves, hydrants and reducers shall be restrained with eye bolts and all thread rods.

10.34 Connections at Structure

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

10.35 Special Exterior Protection for Corrosion

Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be installed parallel to and within 10 feet of, protection shall also be provided. Steel pipe shall not be installed in severe corrosion areas.

10.36 Air Venting and Blow Offs

Where the water main profile is such that an air pocket or entrapment could occur, resulting in flow blockage, methods for air release shall be provided. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants, blow-offs, or other manual devices. At critical points on major mains, automatic air release assemblies shall be installed. Special care shall be taken to preclude any cross-connection possibility in the design of automatic air release valve application.

10.37 Service Connections

Connections to water mains 4 inches and larger shall be made by drilling the appropriate size hole and installation of service saddles, with services to smaller sizes accomplished by in-line fittings. A fitting with the service line extended to the property line or easement line, perpendicular to said line, and terminating with a FORD lock wing curb stop w/swivel connection and meter box, pending meter installation. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb. Where no curb exists or is planned, locations shall be adequately marked by a method approved by the City. Method: ½" steel rebar, 3" below final grade.

A) Any new subdivision consisting of single-family dwellings shall construct a dual water service connection for each single-family dwelling. Each parcel shall have a potable water and a irrigation service available in a double meter box as per detail sheets W-14 (1-2).

10.4 TESTING

- A) The contractor shall perform hydrostatic testing of all water distribution systems, as set forth in the following and shall conduct said tests in the presence of representatives from the City and/or other authorized agencies, with 48 hours advance notice provided, in writing.
- B) Piping and appurtenances to be tested shall be within sections between valves, not exceeding 500 feet unless alternate methods have received prior approval from the City.

Testing shall not proceed until restraining devices are installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

- C) Hydrostatic testing shall be performed at 150 pounds per square inch pressure, unless otherwise approved by the City, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable AWWA provisions for PVC-AWWA Publication M-23 and for DIP-AWWA Standard C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

<u>PVC</u>	—	<u>DIP</u>	
$L = \frac{ND P^{1/2}}{7400}$		$L = \frac{SDP^{1/2}}{133,200}$	

For 150 psi; test: L = 0.00165 ND (PVC)
 For 150 psi; test: L = 0.000092 SD (DIP)

L = allowable leakage in gallons per hour
 N= number of joints in section tested
 S = length of pipe tested, in feet
 D = nominal diameter of the pipe in inches

- D) The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period, by way of a pipe taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.
- E) Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until within the established limits. The contractor shall furnish the necessary labor, water, pumps, gauges and all other items required to conduct the required water distribution system testing and perform necessary repairs.
- F) Pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi for a duration of 2 hours by means of a pump.
- G) After the first initial test, if there is a failure, an additional fee of \$25.00 for every retest will be charged.

10.5 DISINFECTING

10.51 Following the pressure testing: the contractor shall disinfect all sections of the water distribution system, and receive approval thereof from the appropriate agencies, prior to placing in service. Advance notice shall be provided to the City before disinfecting procedures start. The disinfection shall be accomplished with the applicable provisions of AWWA Standard C651, "Disinfecting Water Mains" and all appropriate agency approvals. Computation of the amounts of chlorine to be used for disinfection should be approved by the City or its engineer consultant.

A) Care shall be taken to provide disinfection to the total system and extremities shall be carefully flushed prior to chlorination.

After disinfection and final flushing have been accomplished, samples of water for bacteriological analysis shall be collected and sent to a certified lab, with passing results, then submitted to the Florida Department of Environmental Regulations or other appropriate approval agency.

Should these samples or subsequent samples prove to be unsatisfactory, then the piping shall be disinfected until a sufficient number of satisfactory samples are obtained.

B) The contractor shall furnish all equipment and materials and perform the work necessary for the disinfecting procedures, including additional disinfection as required.

SECTION 11

AS BUILT DOCUMENTATION

11.1 GENERAL

11.10 Recording of Information

11.11 Coordinate System and Datum

11.2 CONSTRUCTION DRAWING SET

11.3 GENERAL INFORMATION REQUIRED

Section 11

AS-BUILT DOCUMENTATION

11.1 GENERAL

The City of Wildwood has adopted an ESRI based Geographic Information Systems (GIS) to store, manage, and maintain spatial (geographical) utility infrastructure data. Since Engineering plans are mostly generated using computer aided design and drafting (CADD) software, it is the goal of the City of Wildwood to leverage these technologies into our as-built utility infrastructure mapping. Standards are required to convert the CADD entities to GIS entities while preserving the quality of the information.

11.10 Recording of Information – Applicants Engineer shall provide record as-built information in both electronic and hard copy mediums.

11.11 Coordinate System and Datum – Horizontal control will utilize the North American Datum of 1983, Florida State Planes, West Zone in US feet. Vertical control will reference the North American Vertical Datum of 1988 and shall be measured in US. Feet. Information shall be captured through traditional survey means. GPS locations captured with recreational GPS receiver that does not allow for post-processed or real time conversion will not be acceptable.

The electronic information shall be burned onto a CD (CD-RW). CD shall be labeled with the following information:

City of Wildwood
(Project Name)
(Street Address)

11.2 CONSTRUCTION DRAWING SET

- A. Signed and sealed drawings supplied in Autodesk AutoCAD 2010 or newer version.
- B. All asset locations (including but not limited to mains, sewer lines, hydrants, valves, fittings and junctions) collected through traditional survey or GPS survey (mapping or survey grade). All GPS locations shall be collected with real-time correction or post processed with differential correction software, i.e. Trimble Pathfinder Office (most current version).
- C. All entities shall be drawn with properties (i.e. line types and colors) by layer.
- D. All layer names shall be easily discernable (i.e. C-WATR-PIPE for water main).
- E. There shall be no disjointed lines or polylines. To the extent possible, lines and polylines shall be continuous.
- F. All assets taken out of service and abandoned or demolished shall be clearly denoted and labeled as such on the plans.
- G. All assets (including but not limited to mains, sewer lines, hydrants, valves, fittings and junctions) shall be clearly represented on drawings with coordinates and top of surface and/or invert elevations (when applicable) labeled on drawing.

- H. As-builts shall be provided with +/- 1' horizontal accuracy and +/- 0.1' for vertical accuracy unless otherwise specified during the preconstruction meeting.

11.3 GENERAL INFORMATION REQUIRED

- A. At a minimum, all as-built record drawings shall contain the following information:
- B. North Arrow with North at the top of the drawing.
- C. Face of curb lines, easement lines, edge of pavement (EOP) or right-of-way lines.
- D. All objects located shall be referenced to other objects with a minimum of two (2) perpendicular measurements. All such measurements shall be from permanent existing structures, such as catch basins, manholes, buildings, etc. (no utility poles).
- E. Pipe diameter and material
- F. Date the water and/or sewer lines were put "in service".
- G. Include valve, hydrant and tap-service identifying numbers for each. Hydrant information shall include manufacturer, size of main, and model number. Numbering system data to be provided by the City of Wildwood.
- H. Reference the Point of Connection where the new main pipeline connects to existing facilities and provide dimensions to nearest existing appurtenance.
- I. If project continues from an existing stub, a dimension from the center line of the nearest street intersection and existing line valve shall be included. Provide coordinates for the referenced existing valve.
- J. All valves, tees, manholes, vaults, hydrants, lift stations, horizontal/vertical bends, restraint locations, and the start and end of the new water main and sewer lines shall be located with coordinates in the specified format and identified and labeled on the drawings.
- K. All rim and invert elevations for manholes shall be labeled on the as-builts.
- L. The invert in, invert out, and slope of all gravity sewers shall be labeled on the as-builts.
- M. Indicated abandoned pipe with type of material and length.
- N. Indicate and locate buried valves (if applicable) with coordinates in the specified format.
- O. Contractor shall provide a GPS or traditional survey line location every 100 LF.
- P. At abrupt changes in pipe elevation, provide a referenced drawing showing the profile of the work and list the material used.
- Q. Projects involving the construction of lift stations shall have as-builts that denote the quantity and location of valves, piping, and all other appurtenances. In addition, the wet well operating levels shall be included on the as-built plan.