

## SECTION 01 89 19 – SANITARY SEWER / WASTEWATER

### 1.01 SUMMARY:

- A. This Section establishes the minimum requirements for the design, specification and construction of the sanitary wastewater collection system, pretreatment units and the wastewater treatment plant and disposal facilities.
1. **Sanitary Wastewater Collection System:** The wastewater collection system shall convey all domestic wastewater from the point of generation to the final point of treatment. <sup>A16</sup>This waste shall be conveyed by gravity, unless site conditions and expected operational and maintenance cost prevent its use. <sup>A16</sup>  
<sup>A7</sup>Industrial and commercial wastewater, if any, shall also be collected within this system after the appropriate pretreatment has been accomplished. <sup>A7</sup>
  2. **Pretreatment Units:** Pollutants contained in wastewater flow which may interfere with operation of the sewage treatment plant or pass through such a plant untreated shall require the installation of a pretreatment unit. Additionally, pretreatment of industrial wastewater shall be appropriate for the chosen sewage treatment plant process.
  3. **Wastewater Treatment Plant and Disposal Facilities:** The treatment system shall be based on extended aeration/activated sludge and treatment requirements shall be determined on the basis of meeting stream and effluent requirements set either by COPANIT Standards.
  4. <sup>A16</sup>**Treatment Units:** When site conditions and expected operational and maintenance cost prevent connecting buildings or facilities to the wastewater collection system, isolated treatment units shall be provided. <sup>A16</sup> Treatment requirements shall be determined on the basis of meeting stream and effluent requirements set either by COPANIT Standards.
  - <sup>A16</sup>5. **Outfalls:** Design of the sanitary sewer outfalls shall take into account the existing water quality conditions of receiving water body and the recommendations of the Environmental Impact Study. Mass balance calculations shall be performed to ensure that discharge quality standards of COPANIT are met.

### 1.02 REFERENCES: <sup>A16</sup>

- A. American Water Works Association (AWWA) Standards
- B. American National Standard Institute (ANSI) Standards
- C. Ductile Iron Pipe Research Association (DIPRA) Standards
- D. American Society for Testing and Materials (ASTM) Standards
- E. International Organization for Standardization (ISO) Standards
- F. <sup>A7</sup>Junta Técnica de Ingeniería y Arquitectura (JTIA) (Panamá): <sup>A7</sup>

<sup>A7</sup>Reglamento para el Diseño Estructural en la

República de Panamá (REP 2004)<sup>A7</sup>

G. **American Concrete Institute (ACI) Publication:**

315-04 Detailing Manual

350-06 [Code Requirements for Environmental Engineering Structures](#)

H. **American Institute of Steel Construction (AISC) Publication:**

Manual of Steel Construction, Thirteenth Edition

I. **American Welding Society (AWS) Publications**

J. **American Association of State Highway and Transportation Officials (AASHTO) Standards**

K. **American Society of Civil Engineers (ASCE) Manuals:**

Manual of Engineering Practice No. 36 [Wastewater Treatment Plant Design \(1977\)](#)

Manual of Engineering Practice No. 60 [Gravity Sanitary Sewer Design and Construction \(2007\)](#)

L. **Instituto de Acueductos y Alcantarillados Nacionales (IDAAN) Publications:**

Normas técnicas para aprobaciones de planos de los sistemas de acueducto y alcantarillado sanitario

M. **Comisión Panameña de Normas y Industriales y Técnicas (COPANIT) – Reglamentos Técnicos:**

24-99 Agua. Calidad de Agua. Reutilización de Aguas Residuales Tratadas.

35-00 Agua. Descarga de Efluentes Líquidos Directamente a Cuerpos y Masas de Agua Superficiales y Subterráneas.

39-00 Agua. Descarga de Efluentes Líquidos Directamente a Sistemas de Recolección de Aguas Residuales.

47-00 Agua. Usos y Disposición de Lodos.

21-393-99 Agua. Calidad de Agua. Toma de Muestra.

N. **Autoridad del Canal de Panamá (ACP):**

<sup>A7</sup>2610ESM-101 Norma para la reducción de la contaminación ambiental por ruido.<sup>A7</sup>

O. **[Water Environment Federation:](#)**

[Manual of Practice FD-10](#) [Wastewater Disinfection\(1996\)](#)

## P. United States Environmental Protection Agency

Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule. (2006)

### 1.03 REQUIREMENTS:

- A. The plants may consist of a patented modular package system or contractor designed system. Patented modular package systems shall have more than 5 years of proven operation in the market. The plant may be constructed of concrete, steel or other corrosion resisting material. Contractor shall ensure constant flow to the plants during any given 24 hours period of operation. A regulating and homogenizing tank may be required. The following are specific requirements for the wastewater treatment plants (WWTP) and disposal sites:
1. WWTP shall be designed to treat all wastewaters produced in the locks during their design life.
    - a. No discharge without treatment will be permitted.
    - b. Wherever required pretreatment shall be provided.
    - c. The toxicity, coliform count, biochemical oxygen demand, chemical oxygen demand, settleable solids, and nutrient load of the waste stream shall be considered in determining its impact on the receiving waters and the appropriate treatment system.
    - d. Dimensioning of the plants shall be determined taking into account the characterization of the wastewaters to be treated.
    - e. An ultraviolet system, in accordance with Water Environment Federation Manual of Practice FD-10 and United States Environmental Protection Agency Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006) shall be used for disinfecting the effluent.
  - <sup>A16</sup>2. The WWTP shall be capable of working in a continuous fashion, even in the case of normal maintenance operation and outages. As a minimum, two treatment modules shall be required with their corresponding interconnection in order to fulfill this condition; each module shall have the capacity to treat half of the influent plus and additional 20%.
  3. The Contractor shall design each treatment unit in the proposed system to avoid potential problems caused by tropical weather, such as, high temperature, torrential tropical rain, and local sewage characteristics variations.<sup>A16</sup>
  4. A potable water supply and sanitary facilities (toilet and lavatory), shall be provided for each plant. The potable water line shall incorporate an approved backflow prevention device to prevent the contamination of the water supply.
  5. Equipment required to maintain the 24 hour operation of the plants shall be connected to the locks' Emergency power system.

6. The general plant layout shall be in accordance with Section 01 81 36.13 (*O&M Building and Facilities – Space Programming*) and shall facilitate the operation and maintenance of the treatment units and their appurtenances.
  - a. Adequate working and storage space shall be provided for all plants.
  - b. Crowding of equipment shall not be allowed.
  - c. Valves and other operating devices shall be readily accessible to avoid injury and encourage proper use so that spillage will be prevented.
  - d. Adequate space shall be provided for storage of process chemicals.
  - e. Provision shall be made for the handling and transportation of process materials, spare parts and maintenance equipment.
7. **Sludge Handling:** Treatment and disposal shall be according to applicable local regulations. The disposal plan shall be considered as part of the wastewater treatment plant design. Disposal sites requirements and sludge handling at the sites shall be designed by the Contractor.
  - a. (Reserved)
  - b. The system shall include a tank with the capacity for the temporary storage of one week of sludge. The sludge in the tank must remain in an aerobic environment with no sedimentation. *Mixing shall be utilized to minimize sedimentation.*
  - c. An area shall be available for the temporary deposit of dehydrated sludge that is accessible by the equipment required for its removal.
8. **Odor Control:** <sup>A7</sup>If routing of exhaust air from the structures identified in Subparagraph 1.03.A.8 is required, a compost filter bed for odor scrubbing shall be implemented.<sup>A7</sup>
9. **Safety Features in Plant Design:** The safety features listed below are minimum general requirements and are not intended to be all-inclusive.
  - a. Assure adequate ventilation in wet wells and dry wells.
  - b. *The design shall include adequate provisions for make-up air as specified in section 01 86 13 (Plant – Mechanical Systems and Equipment).*
    - 1) Positive mechanical ventilation shall be ample in grit and screening chambers as well as in the wet and dry wells.
    - 2) *Wet well ventilation for continuous operation shall provide at least 12 air changes per hour. For intermittent operation, at least 30 air changes per hour shall be provided.*
    - 3) *Dry well ventilation for continuous operation shall provide at least 6 air changes per hour. For intermittent operation, at least 30 complete air changes per hour shall be provided.*
  - c. Stairs shall be used for access to pump rooms in preference to vertical ladders when feasible. <sup>A7</sup>Refer to Section 01 89 16 (*Site Construction*) for stair requirements.<sup>A7</sup>

- d. <sup>A7</sup>Low voltage wiring shall be in accordance with Section 26 20 00 (*Electrical Low Voltage Distribution Work*).<sup>A7</sup>
- e. The design shall prevent the accumulation of potentially explosive gases generated by the plant and processes, or by the chemicals, materials, water and sludge handled. Machinery, pumps, ventilation system, and other equipment and electrical wiring and devices installed where such gases may accumulate shall be explosion proof.
- f. Guards shall be provided for all exposed, moving parts of pumps and equipment.
- g. Hoists and rails for removal of heavy equipment shall be provided for operation and maintenance purposes.
- h. The plant shall be enclosed by a fence to protect the public and the facility. The main access to the plant shall be from an entrance located at the exterior of the lock complex. <sup>A7</sup>The fence shall also permit access from within the lock complex by means of a pedestrian gate that shall be secured to restrict access.<sup>A7</sup>
- i. The water supply shall be protected to eliminate the possibility of contamination by cross connections with sewage or sludge piping.
  - 1) This shall be achieved by a vertical, positive air gap of no less than 2 inches between the inlet and the outlet levels of a fixture.
  - 2) The water line utilized for plant wash down will be provided with a backflow-prevention device.
- j. (Reserved).
- k. Flood lights with local control shall be provided for night-time inspection and maintenance.
- l. A suitable facility for quick drenching or flushing of the eyes and body shall be provided within areas where chemicals are handled, stored or used except when water presence is a hazard with the chemical.
- m. <sup>A7</sup>The noise levels at the plants shall not exceed the maximum allowed by Subparagraph 1.02N for the work environment.<sup>A7</sup>
- n. **Safety Equipment:** Facilities for the following safety equipment shall be provided for at the plant:
  - 1) First-aid kit.
  - 2) Fire extinguishers (type suitable for anticipated fires).
  - 3) Hydrogen sulfide and carbon monoxide indicators.
  - 4) A portable air blower.
  - 5) Rescue floatation equipment.

B. The following are general requirements for the works specified under this Section:

1. The water supply lines shall be protected to eliminate the possibility of contamination by cross connections with sewage or sludge piping, hence a minimum horizontal and vertical clearance shall be attained. This is:
  - a. **Horizontal Clearance:** A separation of 3.00 m is required.
  - b. **Vertical Clearance:** When sewage or sludge pipes cross water supply lines, these shall be installed in such manner that the lower part of the water pipe is separated a minimum of 460 mm over the sewage or sludge pipe.
  - c. Whenever not possible to attain the minimum clearance distance above indicated, provisions shall be made to prevent contamination of water lines.
2. <sup>A7</sup>Except at crossings, sewage and sludge piping shall be separated from storm drains or other sewer mains with a minimum horizontal clearance of 1.5m. <sup>A7</sup>
3. <sup>A7</sup>Except at crossings, sewage and sludge piping shall be separated from other utilities (including underground electric and telecommunications cables) with a minimum horizontal clearance of 1.2m. <sup>A7</sup>
4. Sewer mains shall be designed to run parallel to the street or road centerline. All mains shall have a horizontal clearance from all structures of at least 1.5m.
5. <sup>A7</sup>Clear vehicle access roads are required to every structure in the sewer system and the design of access roads shall be included with the sewer system design plans. Refer to Section 01 89 16 (*Site Construction*) for road requirements. <sup>A7</sup>
6. All equipment with significant noise generation shall be enclosed within buildings or shrouded within sound attenuation structures.
7. Sewage and waste water pipelines shall be constructed of: Ductile Iron (DIP), Polyvinyl chloride (PVC), High Density Polyethylene (HDPE), Glass Reinforced Pipe (GRP), Acrylonitrile-butadiene-styrene (ABS) pipe or Concrete Pipe (CP).

#### 1.04 DESIGN CRITERIA/SYSTEM DESCRIPTION AND PERFORMANCE:

- A. <sup>A16</sup>The design, specification and construction of sanitary sewers in the locks and sanitary sewers and sewage treatment plants and units for the locks shall be in accordance with good engineering practice. <sup>A16</sup> The work shall comply with the standards, publications and manuals listed in Paragraph 1.02 of this Section except where specific modifications have been allowed in the Employer's Requirements.
- B. <sup>A7</sup>The interpretation of "good engineering practice" shall be guided by publications listed under Subparagraphs 1.02 K. and 1.02 L. <sup>A7</sup>
  1. **Sewerage.** <sup>A7</sup>All sewage shall reach the system by gravity flow, in an unadulterated condition susceptible to conventional sewage treatment processes. <sup>A7</sup> If gravity flow is not physically feasible, a sewerage pumping station may be installed. No pumping facilities shall be incorporated in sewer plans without approval of the Employer's Representative.

- <sup>A16</sup>2. **Design, specification and construction** of gravity sewers, force main, pump stations and treatment plant shall be in accordance with “Normas técnicas para aprobaciones de planos de los sistemas de acueducto y alcantarillado sanitario” issued by IDAAN (latest version).<sup>A16</sup>
3. <sup>A7</sup>All pumping stations shall be of the below ground type utilizing submersible pumps, unless otherwise approved by the Employer's Representative.<sup>A7</sup>
- a. Pumping stations shall have a minimum of two equal capacity submersible pumps.
  - b. Pumps shall be sized such that with any one pump off-line the remaining pump(s) can handle the design flow.
  - c. Pumps shall be designed to pass a sphere 75 mm in diameter.
  - d. Pump suction and discharge shall be at least 100 mm in diameter.
  - e. Pumps shall be designed to operate under a positive suction head.
  - f. Pump motors shall be explosion proof where required by code.
4. <sup>A7</sup>Wastewater treatment plants (WWTP) shall be designed to achieve effluent quality standards stipulated in applicable regulations listed in Subparagraph 1.02 M. Specifically, the plants shall:<sup>A7</sup>
- a. Be easy to operate and maintain.
  - b. Require minimum operating personnel.
  - c. <sup>A7</sup>Utilize efficient diffusers at the air/water interchange for maximum reduction in energy.<sup>A7</sup>
5. Equipment for indicating, totalizing and recording the effluent wastewater flow shall be provided for all treatment plants. <sup>A7</sup>The equipment shall meet the requirements of Section 40 95 13.22 (*Wastewater Treatment Control Systems*).<sup>A7</sup>
- a. <sup>A7</sup>Recording and totalizing equipment shall be provided as required to assure effluent limitations within regulations listed under Subparagraph 1.02M.<sup>A7</sup>
  - b. Monitoring equipment shall be used to indicate and record flow quantities, as well as, pressure, temperature, liquid levels; and various quality parameters such as dissolved oxygen, Ph, and. turbidity.
  - c. **Monitoring at pumping stations:** In sewage pumping stations, flow measurement is necessary to control periodic pump operation. Watt-hour meters and pump-time meters shall be used to ensure uniform pump wear in multiple-pump installations.
  - d. **Monitoring of primary treatment:** <sup>A7</sup>Flow measurement and recording as well as grit-level monitoring are the only primary treatment monitoring processes that shall be required.<sup>A7</sup>
6. Provisions for sampling sites shall be included in the plant design. The type of sampling provisions (flow proportional, composite, or grab-sample collection) shall be dictated by the type of sampling required by the Employer's Representative.

7. Treatment plants shall be located a minimum of 30 m from the closest building.
8. Provisions shall be made for standby equipment or bypass piping for situations where process equipment failures are encountered or during routine maintenance.
- <sup>A16</sup>9. The **design, specification and selection** of the process equipment shall consider ease of operations and consistency of treatment performance. Specifically, the Contractor shall not consider equipment that requires considerable operator attention. Operator-free equipment is desirable.<sup>A16</sup>
10. Provisions shall be made for access, maintenance, and removal of process equipment.
11. Stairs, walkways, man ways, and other structures shall be included in the facility design to enhance the routine functions of the operator.

## 1.05 SUBMITTALS

- A. <sup>A7</sup>All drawings and other submittals shall be submitted in accordance with the requirements of Section 01 33 00 (*Submittal Procedures*) and the requirements of this Section for the following phases:<sup>A7</sup>
- <sup>A16</sup>B. **Intermediate Design:** When design has advanced sufficiently to permit the Employer to review the design submitted the Contractor shall submit to the Employer’s Representative:<sup>A16</sup>
  1. <sup>A7</sup>**Drawings:**<sup>A7</sup>
    - a. Preliminary drawings with the minimum requirements set forth in “Normas técnicas para aprobaciones de planos de los sistemas de acueducto y alcantarillado sanitario” issued by IDAAN.
    - b. Preliminary layout of wastewater treatment plant(s)
    - c. Plan and sections of plant.
    - d. Plan and profiles of sewage lines.
  2. <sup>A7</sup>**Documentation:**<sup>A7</sup>
    - a. Capacity of wastewater treatment plant(s).
    - b. Preliminary calculations
    - c. All relevant specifications
- C. **Final Design:** At least 42 days prior to the commencement of any construction work, the Contractor shall submit to the Employer’s Representative for his review:
  1. <sup>A7</sup>**Drawings:**<sup>A7</sup>
    - a. A complete set of drawings with the minimum requirements set forth in “Normas técnicas para aprobaciones de planos de los sistemas de acueducto y alcantarillado sanitario” issued by IDAAN.



- b. Final layout of wastewater treatment plant(s)
    - c. <sup>A7</sup>Plan, sections and details of the plants.<sup>A7</sup>
    - d. Plan and profiles of sewage lines.
  - 2. <sup>A7</sup>**Documentation:**<sup>A7</sup>
    - a. Capacity of wastewater treatment plant(s).
    - b. Calculations
    - c. All relevant specifications
    - d. <sup>A7</sup>A complete maintenance program for the wastewater system. This maintenance program shall include:<sup>A7</sup>
      - 1) <sup>A7</sup>All of the components of the system such as the pretreatment units, pumps, pipes, treatment units, disposal sites, ancillary installations and outfalls.<sup>A7</sup>
      - 2) All details of the operation and maintenance of the wastewater system to include valve or gate settings, piping diagrams, lubrication schedules, safety, emergency operation, sludge disposal and other items of concern.
      - 3) A list of consumables and chemical agents required for operation of the plant for one year.
- D. <sup>A16</sup>**As Built Data:** – The Contractor shall submit for approval:<sup>A16</sup>
  - 1. <sup>A7</sup>**Drawings:**<sup>A7</sup>
    - a. "Record" plans showing the actual location and grade of all sewers after construction. Accurate locations and elevations of all service laterals, manholes, cleanouts, lift stations, pump stations and other sewer appurtenances shall also be recorded.
  - 2. **Documentation:**
    - a. At least two (2) set of the WWTP operating manual shall be provided upon completion of the works and testing. The WWTP operating manual shall contain the following information:
      - 1) Approved Design Report
      - 2) Hydraulic Profile
      - 3) Basic Electrical Schematic
      - 4) Basic Plant Piping Schematic
      - 5) Unit operating Theories and Procedures
      - 6) Recommended Operating Ranges
      - 7) Maintenance Check List
      - 8) Program for Residuals Disposal
      - 9) Parts List

- 10) Copies of All Warranties and Guarantees
  - 11) Trouble-Shooting Guide
  - 12) Permit Requirements
  - 13) Laboratory Requirements and Testing Schedule
  - 14) Operator Requirements and Hours
  - 15) Emergency or Breakdown Procedures
  - 16) All documentation required by this Contract regarding the operation and recommended maintenance programs relating to the various elements of the construction Work.
- b. A Final O & M Manual shall be given to the Employer’s Representative prior to actual start-up of the system. The Employer’s Representative will only approve the date for “initiation of operation” after reviewing the final manual
  - c. <sup>A7</sup>A revised version of the Final O & M shall be prepared and submitted to include any changes resulting from the first year of operation. If no revisions are necessary, the Contractor shall inform the Employer’s Representative accordingly.<sup>A7</sup>
  - d. Updated calculations due to changes during construction.

#### **1.06 QUALITY ASSURANCE**

- A. The Contractor shall, through the Contractor’s Quality Manager, verify conformance with the requirements of this Section. <sup>A7</sup>All requirements in Section 01 40 00 (*Quality Requirements*) shall apply to this Section.<sup>A7</sup>
- B. **General Testing and Procedures:**
  1. Submit a list and technical data of instruments and equipment for inspection and testing.
  2. Submit designation of how quality control testing will be carried out.
  3. Submit Technical Procedures and Methods of Performing Quality Control Inspections for all features of the work.

**END OF SECTION**