



SAN ANTONIO WATER SYSTEM  
 Evans PZ 11A Booster Station Improvements Project  
 SAWS Job No. 13-6003  
 Solicitation No. B-14-052-MF

ADDENDUM NO. 5  
 August 7, 2014

**TO BIDDER OF RECORD:**

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for the Evans PZ 11A Booster Station Improvements Project, for the San Antonio Water System, San Antonio, Texas, Dated July 2, 2014, as fully and completely as if the same were set forth therein.

**PART 1 – TECHNICAL SPECIFICATIONS**

1. Section 11210 Horizontal Split Case Centrifugal Pumps  
**REPLACE** Section 11210 in its entirety with the attached Section.

**PART 2 – CONSTRUCTION PLANS**

1. SHEET C-5: GENERAL NOTES – NOTE 1  
**REPLACE** Note 1 in its entirety with the following:
  1. ASPHALT PAVEMENT SHALL BE REPAIRED TO ITS ORIGINAL CONDITION AFTER COMPLETION OF CONSTRUCTION. INCLUDE 1½" MILL & OVERLAY WITH 728 SY HMAC TYPE 'D', 72.8 GAL OF TACK COAT (AT 0.1 GAL/SQ RATE), PER COSA STANDARD SPECIFICATION ITEM 208 SALVAGING HAULING & STOCKPILING RECLAIMABLE ASPHALTIC PAVEMENT, ITEM 203 TACK COAT & ITEM 205 HOT MIX ASPHALTIC CONCRETE PAVEMENT. PROVIDE FLEXIBLE BASE AS NEEDED TO REPAIR FAILURES IN THE BASE PRIOR TO OVERLAY, AS REQUIRED BY SAWS INSPECTOR.

ALL BIDDERS SHALL ACKNOWLEDGE RECEIPT OF ADDENDUM NO. 5 ON THE BID FORM AND BY HIS/HER SIGNATURE AFFIXED HERETO AND TO FILE SAME AS AN ATTCHMENT TO HIS/HER BID. BID FORMS SUBMITTED WITHOUT THIS ACKNOWLEDGEMENT WILL BE CONSIDERED NON-RESPONSIVE.



**Mark B. Hill, P.E.**  
 Ford Engineering, Inc.  
 TBPE No. F-1162



**ACKNOWLEDGEMENT BY BIDDER**

THE UNDERSIGNED ACKNOWLEDGES RECEIPT OF THIS ADDENDUM NO. 5 AND THE BID SUBMITTED HERewith IS IN ACCORDANCE WITH THE INFORMATION AND STIPULATION SET FORTH.

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Date	Signature of bidder
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Appended hereto and part of Addendum No. 5 is:

- Section 11210 Horizontal Split Case Centrifugal Pumps

END OF ADDENDUM NO. 5

**SECTION 11210**  
**HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS**

**1.00 GENERAL**

**1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to design, manufacture, fabricate, test, and deliver a total of three horizontal centrifugal pumping units to be used at the Evans Pump Station. The units shall be designated as unit HSP 1-11A, HSP 2-11A and HSP 3-11A.
- B. Pumping units shall consist of horizontal, split-case, centrifugal pumps with side suction and side discharge, with horizontal motor, coupling, common pump and motor base, anchor bolts and template, electrical, instrumentation, special services, spare parts, all lubrication and motor oil. Accessories shall be furnished as required for a complete functioning pumping unit in accordance with the specified performance and installation conditions.
- C. The Contractor's Equipment Manufacturer shall be the pump manufacturer and shall be responsible for coordinating the design, factory testing and delivery of the pump and motor. The equipment manufacturer shall be responsible for the adequacy and compatibility of the pump and motor. The Motor Manufacturer shall act as a subcontractor of the Pump Manufacturer. The Motor Manufacturer shall provide a representative who is capable of coordinating the design, factory testing and delivery of the motors. The contractor will install the pumping unit under the supervision and guidance of the Pump Manufacturer's representative.

**1.02 REFERENCED STANDARDS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
  - 1. American Society For Testing And Materials (ASTM)
    - a. ASTM A123—Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
    - b. ASTM A153—Zinc Coating (Hot-Dip) on Iron and Steel Hardware
    - c. ASTM A307—Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
  - 2. American Society Of Mechanical Engineers (ASME)
    - a. ASME B1.1—Unified Inch Screw Threads (UN and UNR) Thread Strength
    - b. ASME B16.1—Cast Iron Pipe Flanges and Flanged Fittings
    - c. ASME B16.5—Pipe Flanges and Flanged Fittings
    - d. ASME B40.1—Gauges-Pressure Indicating Dial Type Elastic Element
  - 3. Hydraulic Institute (HI)
    - a. HI-01—Standards for Centrifugal, Rotary & Reciprocating Pumps
  - 4. Institute of Electrical and Electronics Engineers. (IEEE)
    - a. IEEE 112—Standard Test Procedure for Polyphase Induction Motors & Generators-Test Method B.
  - 5. National Electrical Manufacturers Association (NEMA)
    - a. NEMA MG 1—Motors and Generators
  - 6. National Fire Protection Association (NFPA)

- a. NFPA 70—(1993) National Electrical Code
- 7. National Sanitation Foundation (NSF)
  - a. NSF Standard 61 – Drinking Water System Components

### 1.03 GENERAL REQUIREMENTS

- A. Acceptable Manufacturers for Pumps. The pumps shall be manufactured by ITT Goulds, Flowserve, Patterson, Aurora or Peerless. No other manufacturers will be accepted.
- B. NOT USED.
- C. Experience Requirements: Pumping unit shall be the product of manufacturers who have had at least ten (10) years of successful experience in the design, manufacture and application of pumping units of the type, size, and performance capabilities as specified. The assembly shall be an existing design that has been manufactured and is in operation. Prototype pumps will not be allowed. All manufacturers shall meet ISO 9001 QC System registration.
- D. Description. The pumps shall be horizontal centrifugal water pumps of the types indicated and specified. The single driving units for the pumps shall be electric motors as indicated and specified. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.
- E. Safety Requirements. Gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- F. Nameplates. Each pump and motor shall each have an equipment identification plate that is 16-gauge stainless steel with 1/4 die stamped or high-contrast etched equipment nameplate securely affixed with stainless steel tapping screws in a conspicuous place, showing the ratings, flow (gpm) at rated head (ft), speed (rpm), rotation direction, pertinent bearing and bearing lube information, date of manufacture, serial number, model number, manufacturer, and other pertinent data.
- G. Electrical Work. Electrical motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Division 16. Electrical characteristics shall be as indicated. Motor starters shall be provided complete with properly sized thermal overload protection in each phase and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage and frequency. Manual or automatic control and protective or signal devices required for the operation herein specified and any control wiring required for controls and devices but not shown on electrical plans shall be provided under this section of the specifications.
- H. Selection Criteria. Pumps shall be designed using hydraulic criteria based upon actual model developmental test data. Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations with 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency.
- I. Conformance with Agency Requirements. Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Owner stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency published catalog specification data accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the

applicable requirements of the specifications and the referenced standards, with be considered by the Owner and may be acceptable as evidence that the items conform to agency requirements.

- J. Verification of Dimensions. The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Owner of any discrepancy before performing the work.
1. Shop Tests.
    - a. Each pumping unit shall be tested at the factory for capacity, power requirements, and efficiency at specified rated head, shutoff head, operating head extremes, and at as many points as necessary for accurate performance curve plotting. All tests and test reports shall be made in conformity with the requirements and recommendations of the Hydraulic Institute Standards. Each pumping unit shall be tested with the motor to be installed in the project. Each motor shall be tested per Section 16151 Large Induction Motors.
    - b. Witnessed factory tests are required for all pumps. Four SAWS employees will witness shop tests at the Contractor's expense and inspect and check the testing equipment used. The manufacturer shall include in the total price of his equipment the costs of air transportation from San Antonio International Airport to the test facility, a rental car, lodging for four people in separate rooms. Any part of the day shall be taken as a full day. Manufacturer shall determine the total number of days required to witness the factory tests and any required retests. The Owner will deduct the total amount for witnessing the factory test and any required retests from the total compensation due to the Contractor through a Change Order. Contractor shall furnish Owner a plan and elevation sketch of the test setup showing the piping and instrumentation and shall notify Owner at least 21 days in advance of the time that each shop test will be made. This does not mean the pump unit is to be set up and left for the 21-day notice period. The pump unit needs to be set up in time for the manufacturer's pretest prior to the Owner witnessing the test. If the pump fails to operate properly or fails to meet the specified conditions or requirements during testing, the pump manufacturer shall modify the pump and perform additional tests. The Contractor will be responsible for any expenses incurred by Owner's personnel to witness equipment that does not pass.
    - c. Five certified copies of a report covering each test shall be prepared by the pump manufacturer and delivered to the Engineer not less than 10 days prior to the shipment of the equipment from the factory. The report shall include data and test information as stipulated in the Hydraulic Institute Standards, copies of the test log originals, test reading to curve conversion equations, and certified performance curves.

The curves shall include head, bhp, pump and wire-to-water efficiency, rpm, and shop test  $NPSH_A$  plotted against capacity. The curves shall be easily read and plotted to scales consisted with performance requirements, with all test points clearly shown.

#### 1.04 SUBMITTALS

- A. Drawings and Data. Furnish the following:
1. Submit product data and manufacturer's installation instructions under provisions of Section 01300 Submittals.
  2. Complete assembly, materials list, foundation, and installation drawings, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section.

B. Pumps

1. The data and specifications for the unit shall include, but shall not be limited to, the following:
  - a. Name of Manufacturer
  - b. Type, model, and serial number
  - c. Design rotative speed
  - d. Number of stages
  - e. Weight
  - f. Complete performance curves showing capacity, head, NSPH requirements, pump efficiency, and bhp requirements.
  - g. Data on shop painting.

C. Motors

1. As specified in Section 16151 Large Induction Motors.

D. Product Data. Furnish the following:

1. Materials and Equipment. Manufacturer's descriptive data and technical literature, performance charts and curves for all impeller sizes for a given casing, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply.

E. Drawings. Furnish the following:

1. Centrifugal Pump System. A complete listing of equipment and materials. Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

F. Instructions. Furnish the following:

1. Centrifugal Pump System. Proposed diagrams, instructions, and other sheets, prior to posting. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping valves, and control sequence, frames under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.
2. Training. Training course curriculum and training instructions shall be furnished to the SAWS staff 14 days prior to the start of training.

G. Certificates. Furnish the following:

1. Manufacturer's Field Representative. The names and qualifications of the factory trained representative and training Engineers and written certification from the manufacturer that the representative and trainers are technically qualified.

H. Operation and Maintenance Manuals.

1. Centrifugal Pump System. Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is complete. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:
  - a. System layout showing piping, valves, and controls.
  - b. Approved wiring and control diagrams.
  - c. A control sequence describing startup, operation, and shutdown.
  - d. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.

#### 1.05 DELIVERY AND STORAGE

- A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### 2.00 PRODUCTS

#### 2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified below and as shown, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

#### 2.02 CENTRIFUGAL WATER PUMPS

- A. Pump Service. All pumps shall be utilized for potable water transfer service. Liquid to be pumped is treated potable water with chlorine/chloramines. The pump suction will be from a ground storage vented to the atmosphere. The pumping unit shall be suitable for installation outdoors and above grade, and shall be designated to start and stop against a closed valve.
- B. All pump seals, wear rings, flanges, and bearings associated with the pump shall be designed for operation at the shut-off head condition.
- C. In the event of power or pump failure, a check valve is installed to prevent reverse flow through the pump.
- D. The top of the pump casing shall have a 2" threaded outlet for an air valve assembly that will release air if the pump is drained and re-filled. The air-valve assembly will be provided and installed by the Contractor.
- E. The pumps shall be centrifugal, single-stage, and designed for waterworks service in the following configurations:
  1. Horizontal
  2. PZ 11A Booster Station
    - a. Pump No. HSP 1-11A, HSP 2-11A, and HSP 3-11A
- F. Pump Drives. The pumps shall have electric motor drive units and shall be directly connected to the driving units through solid shafts and flexible couplings.

- G. Pump Construction. Except as specified below, centrifugal water pumps shall be constructed in accordance with the Hydraulic Institute HI-01.
- H. It is desired that the pump have its highest efficiency at the designated optimum head, and this efficiency, as well as the efficiency at other operating conditions will be considered in evaluating the pump.
- I. Pump shall have a continuously rising performance curve from pump run-out to shut-off head with no intermediate flat places.
- J. All wetted materials shall be designed for drinking water contact and shall meet the intent of NSF Standard 61. Leaded bronze materials shall not be used.
- K. The discharge piping includes a flexible pipe coupling and tie rods between the pump discharge flange and the pump control valve as shown in the plan
- L. Pump Characteristics.
  - 1. The pumps shall be capable of discharging quantities at total discharge heads measured at the discharge flange as follows and shall have the following operating conditions:

<b>PUMPING CONDITIONS</b>	<b>HSP 1-11A HSP 2-11A HSP 3-11A</b>
Rated Capacity, MGD	5
Rated Head, FT	323
Minimum Wire-to-Water Efficiency at Rated Head <sup>1</sup>	77.9
Efficiency Calculated At	Rated Head
Minimum Available NPSH, FT <sup>2</sup>	30.4
Motor Voltage	4160
Motor Horsepower, HP	400
Maximum Motor Speed, RPM	1800
Pump rotation as view from driven end	Clockwise

1. Assumed 95% motor efficiency

2. Determined assuming 5-foot water depth in tank

<b>PUMP SETTING REQUIREMENTS</b>	<b>HSP 1-11A HSP 2-11A HSP 3-11A</b>
Elevation of Concrete Support Block	1056.00
Ground Elevation	1055.50
Approximate Elev. of Suction/Discharge Centerline	1058.8
Minimum Discharge Diameter (ID), IN	8
Minimum Suction Diameter (ID), IN	10
Available Space Between Suction and Discharge Flange, IN	43 <sup>1</sup>
Max. Dimension Pump and Motor Base, IN	43x115 <sup>1,2</sup>
Elev. Max. Water Level Suction GST	1125
Elev. Min. Water Level Suction GST	1065

1. Approximate dimensions are to outer edge of motor, pump or baseplate, whichever is greater.

2. Equipment Manufacturer shall field verify with the assistance of Contractor and provide a base that will support the pump and new motor per the Contract Documents.

- 2. Overall (wire-to-water) efficiency for constant speed pumps will include losses in the pump and motor.
- 3. Pumps shall operate at optimum efficiencies to produce the most economical pumping system under the conditions encountered. Pumps shall furnish not less than 115 percent of rated capacity at a total discharge head of not less than 85 percent of total rated head.



4. The pump shall have suitable net positive suction head required (NPSHr). The NPSH margin, i.e. Ratio of NPSHa to NPSHr shall be consistent with the suction energy conditions as defined by the HI standards. Minimum margin shall be 10 percent at BEP, or five (5) feet, whichever is greater. The NPSHr with the margin applied at BEP shall be less than the NPSHa with the minimum suction water level as shown in the pump setting table. The NPSHr with the margin applied at pump run-out shall be less than 50 feet. The GST is open to the atmosphere. For the purposes of calculating NPSHa, the manufacturer may assume the total friction and minor losses in the suction piping (suction tank to pump flange) to be 2 feet from GST to pump for analysis at the optimum head (323') at 5 MGD.

#### M. Pump Casings.

1. Pump casings shall be cast iron of the following design: Horizontal shaft, Horizontal split casing - ALL PUMPS
2. The casings shall be designed to permit replacement of wearing parts. Horizontal-split casing shall have the suction and discharge nozzles cast integrally with the lower half, so that the upper part of the casings may be removed for inspection of the rotating parts without disturbing pipe connections or pump alignment. Pump casings shall be of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Defects in casing shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. Casings shall be double volute with flanged piping connections conforming to ASME B16.1. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.
3. Pump casings must be coated with Belzona or FBE coating.

#### N. Impellers

1. Impellers shall be of strong dense castings free of structural defects with uniform thickness of vanes and shrouds. They shall be the enclosed type and have smooth water passages for high efficiency and shall be statically and dynamically balanced. Perform a single or two plane dynamic balance to ISO Grade 2.5 or better. Thinning of the shroud shall be allowed only when uniform, and spread over as wide an area as possible. An engineering evaluation shall be made by the manufacturer as to the amount of thinning which can be done and still preserve the integrity of the casting. In no case shall the thickness of the shroud be less than this value.
2. Impellers shall be of nickel aluminum bronze ASTM B148 or Type 316 stainless steel. Impellers shall be the enclosed type design.
3. Welding on the raw castings will be allowed as long as the proposed repaired defect is within allowable standards and prior to any machining, polishing, and/or balancing. Welding, fillers or coatings for head, flow, and/or efficiency performance reasons will not be allowed. Submit casting inspection procedure with shop drawings. If weld repair is required, submit inspection report with digital color photographs along with proposed weld procedure for approval prior to performing the work.
4. The Impeller shall be keyed to the shaft and securely held in axial position on the shaft by means of stainless steel sleeves properly secured to the shaft so that it cannot become unfastened when the pump is reversed. All rotating parts of pumps shall be machined true

to insure rotational balance with the impeller, coupling, and other parts that may be mounted on the shaft.

5. Pump vibration levels to be per Hydraulic Institute standards.
- O. Wearing Rings. Wearing rings of bronze ASTM B148 shall be provided for impellers. Wearing rings of a different composition or of a suitable ferrous material shall be provided for pump casings. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.
- P. Shaft shall be of high grade alloy steel AISI 4340, A276 Type 416SS or A576 Type 1045, accurately machined, and shall be of sufficient size and strength to perform the work required. Stainless steel renewable shaft sleeves shall be provided for protection of the shaft in contact with water, and in the mechanical seals. Deflection at the stuffing box shall not exceed 0.002 inch at any operating head.
- Q. Stuffing Boxes
1. Stuffing boxes shall be water sealed, and shall be designed to insure tight seal without excessive wear or friction on the shaft sleeve, and to prevent air leakage into the pump under all conditions of operation.
  2. The stuffing box shall be fitted with a mechanical seal. The hardware shall be 316 stainless steel, rotary face shall be silicon carbide, stationary face shall be carbon, and elastomers shall be EPDM. Stainless steel piping for recirculation shall be provided from the discharge side of pump to the seal. The seal installation shall be inspected by the seal manufacturer prior to testing the pump. Mechanical seals shall be the split-type as manufactured by the following manufacturers:
    - a. Flex-A-Seal, Style 85.
    - b. Chesterton, Type 442
    - c. No other manufacturers will be accepted
  3. Drip pockets shall be provided for all water sealed glands and the Contractor shall provide piping to common drains to take care of leakage.
- R. Couplings. Couplings shall be of the heavy-duty flexible type, keyed and locked to the shaft. The outside surface of the couplings for horizontal pumps and shall be machined parallel to the axis of the shaft. The faces of the couplings shall be machined perpendicular to the axis of the shaft. Disconnecting the couplings shall be accomplished without removing the driver half or the pump half of the couplings from the shaft. Flexible couplings shall not be used to compensate for misalignment of pump.
- S. Balance. All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments will be sufficient cause for rejection of the equipment. Pump impeller assemblies shall be statically and dynamically balanced to within ½ percent of W times R squared, where W equals weight and R equals impeller radius. Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump-seal face shall not exceed 2.0 mils under shutoff-head operating conditions. Flow from ¼-inch iron pipe size (ips) pipe shall be provided during testing. Vibration tests will be conducted at startup by an independent third party agreed to by the Contractor and the Owner.
- T. Bearings. Bearings shall be oil lubricated anti-friction ball type adequately sized to carry radial and thrust loads without the addition of external cooling. Anti-friction bearings shall have a L-10 bearing life of 100,000 hours at the rated head and flow of the pump in accordance with the standards of the Bearings Manufacturers Association. No cast-in

bearings will be allowed, so that a spare rotating assembly could be easily installed. Bearings oil baths shall have a constant level oiler. All include a site glass or bullseye oil level indicator. Bearing oil bath shall be designed for adequate lubrication at maximum forward and reverse speeds. Bearing isolators shall be Inpro.

- U. Lubrication. Bearings on horizontal-shaft pumps shall be oil-bath type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Lubrication system shall be gravity fed. All lubrication points and vents shall be free of paint and/or other obstructions. The sight glass shall be a "oil rite" sight gage.
- V. Base Plates. Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. The drainage structure shall collect the packing box leakage and shall have a 1-inch NPT connection to connect it to a drain. Pump base shall be provided with adequate openings to facilitate grouting and openings for electrical conduits. Detailed drawings of the pump base shall be submitted to the Engineer for review prior to fabrication.
- W. Cocks, Plugs, and Accessories. The pumps shall be equipped with air cocks, drain plugs, and single gauges indicating discharge pressures for all pumps and suction pressures for pumps without suction lift. Gauges, equipped with a shutoff cock and snubber, shall conform to ASME B40.1, and shall be calibrated in pounds per square inch in not more than 2-psi increment. Gauge ranges shall be appropriate for the particular installation. Normal operating suction and discharge pressures of the pump shall be indicated on the mid-point range of the gauges. Gauges equipped with a shutoff cock and snubber shall conform to ASME B40. 1 and shall be calibrated in feet of head. Gauges shall be glycerin filled up to 4 – inches.
- X. Piping Connections. The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Pipe flanges shall conform to ASME B16.1 and ASME B16.5. Piping shall be installed to preclude the formation of air pockets.
- Y. Finish. See paragraph 2.04C.

## 2.03 ELECTRICAL EQUIPMENT

- A. Electrical equipment shall conform to Section 16010 General Requirements for all Electrical Work.
- B. Electric Motors. Refer to electrical specifications.

## 2.04 EQUIPMENT APPURTENANCES

- A. Attachments. All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment. Bolts shall conform to the requirements of ASTM A 307 and nuts shall be hexagonal of the same quality as the bolts used. Threads shall be clean-cut and shall conform to ASME B1.1. Bolts, nuts, and washers specified to be galvanized or not otherwise indicated or specified, shall be zinc coated after being threaded, by the hot-dip process conforming to ASTM A 123 as appropriate. Bolts, nuts, and washers specified or indicated to be stainless steel shall be Type 316.
- B. Equipment Guards. Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

- C. Shop Painting. All motors, pump casings, and similar parts of equipment customarily finished in the shop shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with Section 09985 Protective Coatings. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Each pump and motor shall be installed in accordance with the written instructions of the manufacturer. The pumping unit shall be leveled, aligned, and wedged into position to fit connection piping. Installation procedures shall be as recommended by the pump manufacturer, the Hydraulic Instituted Standards, and as required herein. Alignment tolerances will be based on the pump manufacturer's requirements not the tolerances of the flexible coupling. Grouting shall be as specified in Section 03600 Grout. The pump base shall be grouted after initial fitting and alignment, but before final bolting of connecting piping. The base shall be sounded after the grout has set and re-grouted if hollows are found. Special care shall be taken to maintain alignment of pumping unit components. No stresses shall be transmitted to the pump flanges. After final alignment and bolting, pump connections shall be tested for applied piping stresses by loosening the flange bolts. Production Department Mechanical Maintenance Supervisor as well as the SAWS Engineer shall witness alignment. Contractor shall furnish a new dial indicator (Starrett or approved equal) with Blohm chain indicator holder and taper gauge for angular adjustment. These instruments are to be given to the SAWS Engineer after the alignment process is completed. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit. Couplings shall be realigned after grouting. Anchor bolts and connections shall be as shown on the drawings.
- B. The pump manufacturer's qualified technical representative shall check final alignment prior to official startup in the presence of Owner personnel and make necessary adjustments as requested by Owner. Final field alignment measurements/profiles shall be submitted to the Owner at official startup.
- C. Concrete Foundations. Concrete for equipment foundations shall be as specified in Section 03300 Cast-In-Place Concrete. Concrete foundations shall be integral with and of the same class as that of the building floor unless otherwise indicated. Concrete having a compressive strength of at least 3,000 psi shall be used in foundations that are entirely separated from the surrounding floor. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.
- D. Field Acceptance Tests.
  - 1. After initial startup the supervision of a qualified representative of the pump manufacturer, a period will be provided for the Contractor to make field tests and necessary adjustments. The Owner will then operate the pump(s) for 30 calendar days.
  - 2. Owner will pay for initial testing of equipment. Any required retesting due to failure of performance will be at the Contractor's expense.
  - 3. At the end of 30 days of operation by the Owner the pump will be accepted, if in the opinion of the Owner the pump has operated satisfactorily without excessive power input, wear, lubrication, or undue attention required for its operation, and if all rotating parts operate without excessive vibration or noise at any operating head, including shutoff.

#### **3.02 FIELD PAINTING**

- A. Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.
- B. Touch-Up Painting. Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and top-coated in accordance with Section 09985 Protective Coatings.

- C. Exposed Ferrous Surfaces. Exposed ferrous surfaces shall be painted with two coats of enamel paint conforming to FS TT-E-489, Class A. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with the enamel paint manufacturer's recommendations.

3.03 MANUFACTURER'S FIELD SERVICES

- A. The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment. Up to 7 days service shall be provided at no expense to the Owner.

3.04 DEMONSTRATION

- A. Upon completion of the work and at a time designated by the Owner, the services of one or more competent Engineers shall be provided by the Contractor for a period of not less than 8 hours to instruct a representative of the Owner in the operation and maintenance of equipment furnished under this section of the specifications. These field instructions shall cover all the items contained in the bound instructions.

**END OF SECTION**

**PUMP DATA SHEET**  
**HORIZONTAL SPLIT-CASE CENTRIFUGAL PUMPS**

Project: <u>Evans PZ 11A Booster Station Improvements Project</u>	Pump Mfr: _____
Owner: <u>San Antonio Water System</u>	Size & Type: _____
Service: <u>Potable Water</u>	No. Stages: _____
Pump Name: _____	Serial No.: _____
Equip. Tag Number(s): _____	Model No.: _____

No. Pumps Required: _____	No. Motor Driven: _____	No. Turbine Driven: _____
Drive Type: <input type="checkbox"/> Constant <input type="checkbox"/> Adjustable	Pump Item No.: _____	Pump Item No.: _____

LIQUID	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: _____	Rated Condition: _____	Temp (°F) Max ____ Min ____
Pumping Temperature (°F): _____	Capacity (U.S. gpm): _____	Rel. Hum (%): Max ____ Min ____
Normal ____ Max ____ Mm ____	Total Dynamic Head (ft): _____	Altitude (ft): _____
Specific Gravity @ ____ °F: _____	NPSH Available (ft): _____	<input type="checkbox"/> Indoor <input type="checkbox"/> Heated
Vapor Pressure (psia): _____	H.P. _____	<input type="checkbox"/> Outdoor <input type="checkbox"/> Unheated
Viscosity (CP) @ <u>70</u> OF: <u>0.98</u>	Remarks: <u>Designed to start</u>	Area Classification: <u>Unclassified</u>
PH: _____	<u>And stop against a closed valve</u>	Other: _____
Corrosion/Erosion/Abrasion Caused by: _____	Remarks: _____	_____
Remarks: _____	_____	_____
_____	_____	_____
_____	_____	_____

**PERFORMANCE REQUIREMENTS (manufacture to supply missing data)**

Proposal Curve No. _____	Mm. Continuous Flow (gpm): _____	NPSH Required (ft water): _____
Pump Speed (rpm): _____	Max. Head, Rated Imp. (ft): _____	Head Drop _____
Efficiency (%): _____	Max. Power, Rated Imp (BHP): _____	Suction Specific Speed _____
Rated Power (BHP): _____	Factory Testing: _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Remarks: _____	_____	_____
_____	_____	_____
_____	_____	_____

Equipment Tag Numbers(s):

**PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)**

	Nozzles			Miscellaneous Connections	
	<u>Size</u>	<u>Rating</u>	<u>Facing</u>	<u>Location</u>	<u>Size</u>
Suction	___	150 lb	Flat	Side	Drain
Discharge	___	150 lb	Flat	Side	Vent
					Pres. Gauge
					Warm Up
Casing Mount: <input type="checkbox"/> Soleplate		Impeller Diameter (in.)		Bearings (Type/No.): Antifriction	
				With AFBMA L-10 life of 40,000	
				Hours	
<input type="checkbox"/> Centerline	<input type="checkbox"/> Bracket	Rated _____	Max _____	Min _____	Radial _____ Thrust _____
<input type="checkbox"/> Near Centerline					Lubrication Type:
Casing Type:					<input type="checkbox"/> Grease <input checked="" type="checkbox"/> Oil
<input type="checkbox"/> Single Volute	<input type="checkbox"/> Diffuser				Coupling:
<input type="checkbox"/> Double Volute	<input type="checkbox"/> Staggered				Manufacturer: _____
					_____
Hydro Test Pressure (psig):		Mechanical Seal:			Type: _____ Model: _____
Field Testing: <input type="checkbox"/> Not Required		Type: _____			Driver Half-Coupling Mounted by:
<input type="checkbox"/> Required, functional and Performance		Manufacturer: _____			<input type="checkbox"/> Pump Mfr. <input type="checkbox"/> Drive Mfr.
		_____			<input type="checkbox"/> Purchase
		Model _____			Gland Type/Material:
		Manufacturer Code _____			<input type="checkbox"/> Quench <input type="checkbox"/> Flush
					<input type="checkbox"/> Drain <input type="checkbox"/> Vent

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**MATERIALS (manufacturer to supply missing data)**

Case: _____	Impeller: _____	Shaft: _____
Case Wear Rings: _____	Impeller Wear Rings: _____	Shaft Sleeve: _____
		Baseplate: _____
		Material: _____
	Bronze _____	_____

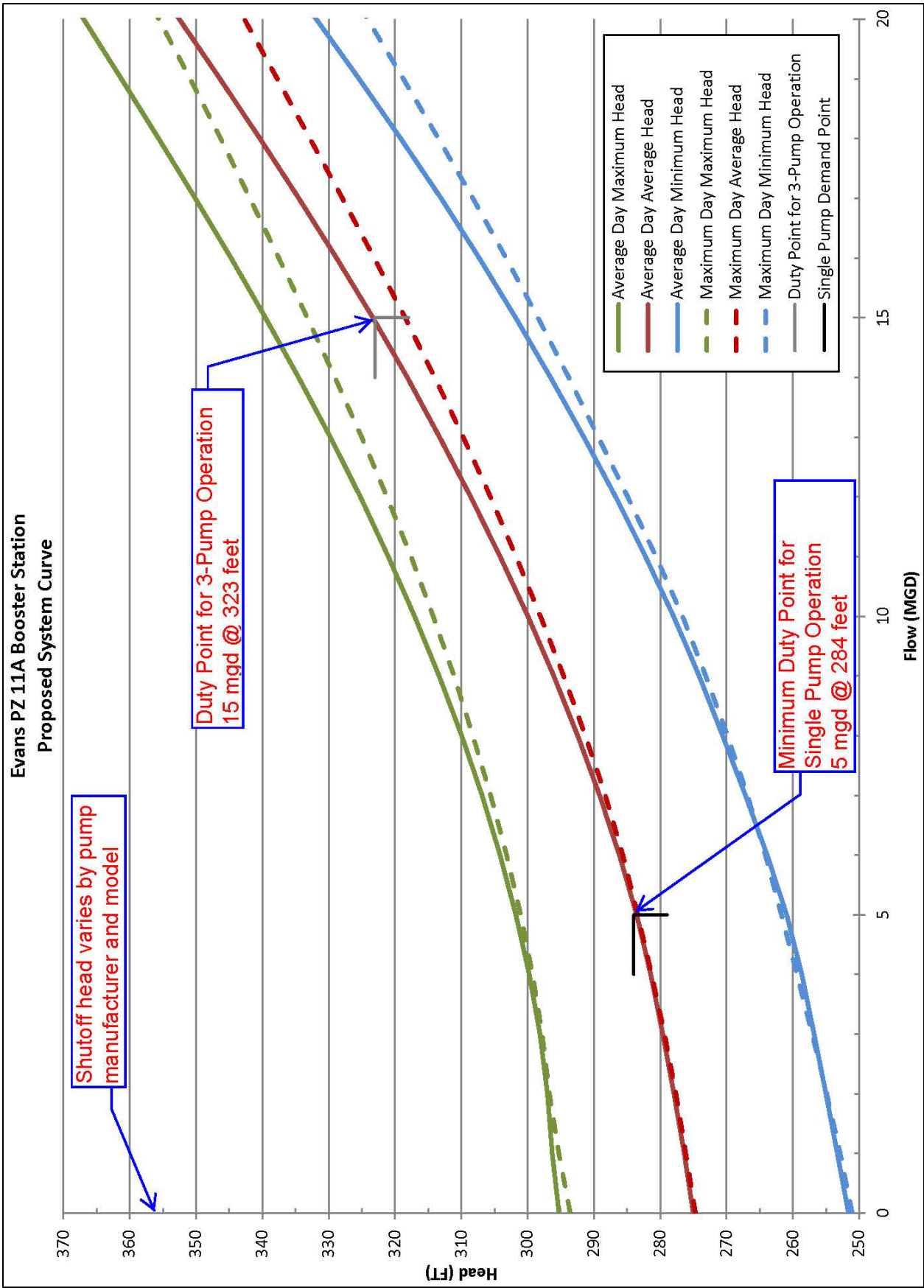
Remarks: \_\_\_\_\_

**ADDITIONAL REQUIREMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## **APPENDIX: SYSTEM HEAD CURVES**





**Table 1 System Head Curve Values**

<b>Flow (mgd)</b>	<b>Ave. Day Max. Head</b>	<b>Ave. Day Ave. Head</b>	<b>Ave. Day Min. Head</b>	<b>Max. Day Max. Head</b>	<b>Max. Day Ave. Head</b>	<b>Max. Day Min. Head</b>
0	295.28	275.03	251.62	293.60	274.71	251.06
1	296.30	276.39	253.30	295.31	276.16	252.88
2	297.02	277.95	255.05	296.72	277.66	254.92
3	298.15	279.64	256.82	297.83	279.37	257.10
4	299.76	281.44	258.67	299.26	281.32	259.40
5	301.79	283.58	260.96	301.05	283.42	261.74
6	304.18	286.18	263.90	303.19	285.65	264.15
7	306.89	289.15	267.18	305.60	288.29	266.87
8	309.96	292.46	270.62	308.25	291.29	269.89
9	313.36	296.07	274.13	311.12	294.57	273.17
10	317.05	299.98	278.02	314.24	298.07	276.67
11	321.02	304.17	282.24	317.61	301.74	280.66
12	325.23	308.61	286.75	321.22	305.61	284.94
13	329.76	313.28	291.54	325.04	309.71	289.35
14	334.55	318.17	296.58	329.06	314.02	293.83
15	339.55	323.35	301.82	333.23	318.50	298.44
16	344.75	328.83	307.32	337.54	323.15	303.27
17	350.14	334.51	313.06	341.90	327.95	308.28
18	355.66	340.37	319.16	346.30	332.84	313.45
19	361.29	346.38	325.45	350.89	337.77	318.75
20	366.95	352.53	331.89	355.62	342.71	324.13