

SECTION B

PART III

SPECIFICATIONS

1.0 LINE ITEM NO. 1 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flygt

Model: Model No. NS 3102 or City Approved Equal

1.1. SUMMARY OF REQUIREMENT:

1.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

1.1.2 The pump shall be rated for wastewater applications.

1.2. PUMP SPECIFICATIONS:

1.2.1 **SPECIFICATIONS 5 HP, 4 INCH SUBMERSIBLE PUMP, 385 GPM @ 30 TDH**

1.2.2 **REQUIREMENTS**

Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a **5** HP submersible electric motor, connected for operation on **230 and 460 volts, 3 phase**, 60 hertz, **4** wire service, with **50** feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing **4 inch** Flygt Corporation discharge connection with no modification or extra cost to the City. **The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of 385 GPM at 30 TDH.** The pump shall operate at the design condition with an efficiency of **72.5%**. **The pump shall also be able to operate 800 GPM at 8 feet total head with out vibration or cavitations. Shut off head shall be 51 feet (minimum).**

1.2.3 The pump must be able to be installed in dry pit application with no modification and be rated for continuous duty in a completely dry environment.

1.3 **PUMP DESIGN**

The pumps shall be capable of being used in a portable configuration or with a Flygt guide rail configuration with existing discharge connections.

1.4 **PUMP CONSTRUCTION**

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

1.4.1 Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

1.4.2 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

1.5 COOLING SYSTEM

Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

1.6 MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

1.7 BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L₁₀ bearing life shall be 50,000 hours at any usable portion of the pump curve.

1.8 MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

1.8.1 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

1.8.2 The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

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1.8.3 A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

1.9 PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

1.10 IMPELLER

The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

1.11 VOLUTE/SUCTION COVER

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged groove(s) that is cast into the suction cover. The spiral groove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

1.12 PROTECTION

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

1.13 The thermal switches and float switch shall be connected to the existing Mini CAS control and status monitoring unit. If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.

1.14 DELIVERY/PERFORMANCE TIME:

The contractor/supplier shall be required to deliver the specific pump(s) to the City of Houston location specified in the purchase order (PO) no later than 112 Calendar days after receipt of the City of Houston P.O.

1.15 LITERATURE, TOOLS AND SPARE PARTS:

The Contractor shall be required to provide four (4) Operations and Maintenance manuals with the delivery of pump(s).

1.16 WARRANTY:

The manufacturer shall provide a one (1) year warranty from the date of final system acceptance. Removal and reinstallation is by the City. All shipping charges for warranty work that is required outside of the Houston area will be borne by the supplier.

2.0 LINE ITEM NO. 2 PUMP, ELECTRICAL, SUBMERSIBLE

Make: Flygt

Model: Model No. 3085 or City Approved Equal

2.1 SUMMARY OF REQUIREMENT:

2.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

2.1.2 The pump shall be rated for wastewater applications.

2.2 PUMP SPECIFICATIONS:

2.1.1 Flygt pump (ABW's washwater) threaded handle for securing pump

2.1.2 3 inch discharge two bolt , bolt up flange

2.1.3 Head code: MT (Medium Head)

2.1.4 3 hp.

2.1.5 460 volts

2.1.6 3 phase

2.1.7 Model 3085

2.1.8 Explosion proof

2.1.9 50 foot power cord

2.1.10 RPM 1750

2.1.11 electric submersible

2.1.12 50 Hertz

2.3 DELIVERY/PERFORMANCE TIME:

The contractor/supplier shall be required to deliver the specific pump(s) to the City of Houston location specified in the purchase order (PO) no later than 112 Calendar days after receipt of the City of Houston P.O.

2.4 LITERATURE, TOOLS AND SPARE PARTS:

The Contractor shall be required to provide four (4) Operations and Maintenance manuals with the delivery of pump(s).

2.5 WARRANTY:

The manufacturer shall provide a one (1) year warranty from the date of final system acceptance. Removal and reinstallation is by the City. All shipping charges for warranty work that is required outside of the Houston area will be borne by the supplier.

3.0 LINE ITEM NO. 3 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flygt

Model: Model No. 3085 or City Approved Equal

3.1 SUMMARY OF REQUIREMENT:

3.3.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's 69TH Street Wastewater Treatment Plant.

3.3.2 The pump shall be rated for wastewater applications.

3.2 PUMP SPECIFICATIONS:

- 3.2.1 Flygt pump (ABW's backwash)
- 3.2.2 3 inch discharge flanged bolt up four bolt
- 3.2.3 Head code: MT (Medium Head)
- 3.2.4 3 hp.
- 3.2.5 460 volts
- 3.2.6 3 phase
- 3.2.7 Model N 3085
- 3.2.8 Explosion proof
- 3.2.9 50 foot power cord
- 3.2.10 RPM 1750
- 3.2.11 electric submersible
- 3.2.12 50 Hertz

3.3 DELIVERY/PERFORMANCE TIME:

The contractor/supplier shall be required to deliver the specific pump(s) to the City of Houston location specified in the purchase order (PO) no later than 112 Calendar days after receipt of the City of Houston P.O.

3.4 LITERATURE, TOOLS AND SPARE PARTS:

The Contractor shall be required to provide four (4) Operations and Maintenance manuals with the delivery of pump(s).

3.5 WARRANTY:

The manufacturer shall provide a one (1) year warranty from the date of final system acceptance. Removal and reinstallation is by the City. All shipping charges for warranty work that is required outside of the Houston area will be borne by the supplier.

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4.0 LINE ITEM NO. 4 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. NS 3300 or City Approved Equal

4.1 SUMMARY OF REQUIREMENT:

4.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

4.1.2 The pump shall be rated for wastewater applications.

4.2 PUMP SPECIFICATIONS:

Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a 60 HP, **explosion-proof** submersible electric motor connected for operation on 460 volts, three phase, 60 hertz, 4 wire service with 50 feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. **THE PUMP WILL HAVE ONLY ONE CABLE FOR POWER AND CONTROL COMBINED, TO MATCH EXISTING CONDUIT.**

4.3 PUMP DESIGN CONFIGURATION

Pump shall be capable of operating in a continuous non submerged condition. The City shall be able to move this pump to a dry-pit application with no changes to the pump. The pump shall be capable of connecting to the existing 12 inch discharge connection and be capable of delivering 4722 GPM at 38.2 FT. TDH at 78.6 % efficiency with a maximum NPSHre of 12.4 and a maximum shaft hp of 58. Additional points on the same curve shall be 2500 GPM at 56 feet total head and 7750 GPM at 15 feet total head. Shut off head shall be 73 feet minimum. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. **Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.** No portion of the pump shall bear directly on the sump floor. **The pump must be supplied with a drilled flange and stand for portable use.**

4.4 PUMP CONSTRUCTION

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

4.5 Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

4.6 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

4.7 COOLING SYSTEM

Each unit shall be provided with an adequately designed cooling system. The water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104°F. Restrictions below this temperature are not acceptable.

4.8 CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. **The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.**

4.9 MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant **Class H insulation rated for 180°C (356°F)**. The stator shall be insulated by the trickle impregnation method using **Class H monomer-free polyester resin** resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of (40°C) (104°F) and capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

4.9.1 The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

4.9.2 The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

4.9.3 The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

4.10 BEARINGS

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact ball bearings to compensate for axial thrust and radial forces. **605, 665 drive motors:** The upper bearing shall be a single roller bearing. The lower bearing shall consist of one single-row angular contact ball bearing and one roller bearing. **Single row lower bearings are not acceptable.**

4.11 MECHANICAL SEAL

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant **tungsten-carbide** ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating **tungsten-carbide** seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor **depend on direction of rotation for sealing**. For special applications, other seal face materials shall be available.

4.11.1 The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

4.11.2 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. **The motor shall be able to operate dry without damage while pumping under load.**

4.11.3 Seal lubricant shall be FDA Approved, nontoxic.

4.12 PUMP SHAFT

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of carbon steel ASTM A 572 and shall be completely isolated from the pumped liquid. Shaft material on 6x5 and 7x5 drive units shall be stainless steel – ASTM A479 S43100-T.

4.13 IMPELLER

The impellers shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Impeller(s) shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum ___ inch diameter solid.

4.14 WEAR RINGS

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.

4.15 This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

4.16 VOLUTE

Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

4.17 PROTECTION

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

4.23.1 A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.**

4.23.2 The thermal switches, and FLS shall be connected to the existing Mini CAS (Control and Status) monitoring unit.

4.18 MODIFICATIONS

Explosion-proof motors are required.

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5.0 LINE ITEM NO. 5 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flygt

Model: Model No. NS 3201 or City Approved Equal

5.1 SUMMARY OF REQUIREMENT:

5.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

5.1.2 The pump shall be rated for wastewater applications.

5.2 SPECIFICATIONS FOR A 35 HP, SUBMERSIBLE 8" PUMP, 2400 GPM @ 42 TDH

5.3 REQUIREMENTS

Furnish 1 submersible non-clog wastewater pumps. Each pump shall be equipped with a 35 HP submersible electric motor, connected for operation on 230/460 volts, 3 phase, 60 hertz, 4 wire service, with 50 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing 8 inch discharge connections with no modification or extra cost to the City. **The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of 2400 GPM at 42 TDH. The pump shall operate at the design condition with an efficiency of 80 %. The pump shall also be able to operate 3600 GPM at 20 feet total head with out vibration or cavitations. Shut off head shall be 82 feet (minimum).**

5.4 The pump must be able to be installed in dry pit application with no modification and be rated for continuous duty in a completely dry environment.

5.5 PUMP DESIGN

The pumps shall be capable of being used in a portable configuration or with a Flygt guide rail configuration with existing discharge connections.

5.6 PUMP CONSTRUCTION

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

5.6.1 Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

5.6.2 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

5.7 COOLING SYSTEM

Each unit shall be provided with an integral motor cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F. (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

5.8 MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

5.8.1 The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

5.8.2 The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

5.8.3 Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

5.9 BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L₁₀ bearing life shall be 50,000 hours at any usable portion of the pump curve.

5.10 MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

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5.10.1 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

5.10.2 The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

5.10.3 A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

5.11 PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

5.12 IMPELLER

The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

5.13 VOLUTE/SUCTION COVER

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged groove(s) that is cast into the suction cover. The spiral groove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

5.14 PROTECTION

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

5.15 The thermal switches and float switch shall be connected to the existing Mini CAS control and status monitoring unit. If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.

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6.0 LINE ITEM NO. 6 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. NP 3202X or City Approved Equal

6.1 SUMMARY OF REQUIREMENT:

6.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

6.1.2 The pump shall be rated for wastewater applications.

6.2 The pump specified in this section will be used to drain Clarifiers, Aeration Basins and Chlorine Contact Basins and shall have drilled flange for portability.

6.3 Operating Flow (Required)	4350 GPM @18 TDH
6.4 Second duty point	5500 GPM @ 8 TDH
6.5 Minimum pump efficiency at operating flow	70%
6.6 Minimum Shut-Off Head	45 feet
6.7 Maximum NPSHr at Operating Flow	21.7 feet
6.8 Voltage	460 V
6.9 Power Cable(s)	50 feet
6.10 Frequency	60 Hz
6.11 Discharge size	12 inch

6.12 EQUIPMENT

CASING and VOLUTE: Pump castings shall be cast iron conforming to ASTM A48, Class 35B or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Surfaces coming into contact with sewage, other than stainless steel shall be protected by an approved sewage resistant coating. Mating surfaces shall be watertight sealed. Seal shall be maintained in a wastewater environment. Fittings shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. No secondary sealing compounds, rectangular gaskets, elliptical o-rings, grease or other devices shall be used.

6.13 IMPELLERS: The pump impeller shall be non-clog designed with smooth passage to pass liquid, solids of at least 3 inches and prevent clogging of stringy, fibrous material. Impeller shall also be able to withstand solids, fibrous material, wastewater sludge and other material present in wastewater. The impeller material type made of cast iron conforming to cast iron, Class 35B or better. Rotation of the impeller shall be secured via a shaft key or other locking mechanism. Impeller shall be of Rockwell Hardness C 45.

6.14 WEAR RINGS: Pump shall be furnished with the volute and impeller. They must be fully adjustable and easily replaceable. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.

6.15 BEARINGS AND SHAFTS: Bearings must be permanently lubricated and rated in accordance with Anti-Friction Bearing Manufacturers Association for a minimum L₁₀ bearing life of 50,000 hours at any useable portion of the pump curve. Upper bearing shall be suitable for radial loads. Lower bearing shall be capable of taking axial load in either direction as well as radial load to counter the moment on the shaft. Shafts utilizing mechanical coupling shall not be allowed. Shaft shall be AISI type 431 stainless steel.

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- 6.16 MOTOR: Motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. Windings shall have insulation class H or better. Motor must be designed specifically for submersible pump usage (water tight). Motor shall be non-overloading for the entire range of the operating curve within the name plate H and shall be capable of no less than 15 evenly spaced starts per hour. A performance chart shall be provided showing curves for torque, current, a minimum service factor of 1.15, input/output kW and efficiency. Motor shall be sized to be non-overloading throughout the entire performance curve to include shut-off to run-off.
- 6.17 SEAL: Each pump shall be provided with a tandem mechanical shaft seal system. The upper seal set shall contain one stationary tungsten-carbide ring and positively driven rotating tungsten ring and functions as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal shall function as the primary barrier between the pumped liquid and the oil housing. This set shall contain one stationary tungsten-carbide ring and positively driven rotating tungsten ring
- 6.18 PROTECTION: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped in the end of the coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. The pump shall be equipped with moisture sensors in the oil filled seal chamber to indicate seal leakage.
- 6.19 COOLING: Cooling jacket shall be provided to allow pump to be cooled while water level is at the top of volute. The cooling system shall provide continuous pump operation in liquid or ambient temperatures of 104°F.
- 6.20 ENVIRONMENT: Pump needs to be able to withstand wastewater conditions. Pump, motor and cable shall be designed for continuous submersible use without loss of water tight integrity.

6.21 DELIVERY

- 6.2.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 6.2.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 6.2.3 The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 6.2.4 Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

6.22 TOOLS AND SPARE PARTS

- 6.22.1 Two (2ea) Kellems Grips shall be provided
- 6.22.2 Four (4ea) O&M (Operations and Maintenance manuals).

6.23 WARRANTY

One (1) year warranty from the date of final system acceptance.

6.24 MANUFACTURERS/VENDOR SERVICES

- 6.24.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:
- 6.24.2 Provide complete training and local service capability for a period of not less than one half day.
- 6.24.3 Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.
- 6.24.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

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7.0 LINE ITEM NO. 7 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. N3085 or City Approved Equal

7.1 SUMMARY OF REQUIREMENT:

7.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

7.1.2 The pump shall be rated for wastewater applications.

7.2 The pump specified in this section will be used to backwash the effluent automatic backwash filter system

7.3 Operating Flow (Required)	300 GPM @ 14.5 feet TDH
7.4 Second Duty Point	450 GPM @ 7 feet TDH
7.5 Minimum Shut-Off Head	25 feet
7.6 Maximum NPSHr at Operating Flow	13.2 feet
7.7 Voltage	460 V
7.8 Power Cable(s)	50 feet
7.9 Frequency	60 Hz
7.10 Discharge Size	3 inch centerline
7.11 Discharge Flange Configuration	2 bolt matching existing equipment

7.12 CASING and VOLUTE: Pump castings shall be cast iron conforming to ASTM A48, Class 35B or better. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. Thickness and weight shall insure long life, accurate alignment and reliable operation. Surfaces coming into contact with pumpage, other than stainless steel shall be protected by a factory applied coating. Mating surfaces shall be watertight sealed. Seal shall be maintained in a wastewater environment. Fittings shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. No secondary sealing compounds, rectangular gaskets, elliptical o-rings, grease or other devices shall be used. The pump shall be supplied with a two bolt

7.13 IMPELLERS: The pump impeller shall be semi-open, multi-vane, back-swept and non-clog. Impeller shall be designed with smooth passage to pass liquid, solids of at least 3 inches and prevent clogging of stringy, fibrous material. Impeller shall also be able to withstand solids, fibrous material, wastewater sludge and other material present in wastewater. The impeller material type made of cast iron conforming to cast iron, Class 35B or better. Rotation of the impeller shall be secured via a shaft key or other locking mechanism. Impeller vanes shall have screw –shaped leading edges that are hardened to Rockwell Hardness C 45. Sharp spiral grooves shall provide the shearing edge across which each impeller vane leading edge shall cross during its rotation in order to remain unobstructed. Clearance between the internal volute bottom and the impeller leading edges shall be adjustable.

7.14 BEARINGS AND SHAFTS: Bearings must be permanently lubricated and rated in accordance with Anti-Friction Bearing Manufacturers Association for a minimum L_{10} bearing life of 50,000 hours at any useable portion of the pump curve. Upper bearing shall be suitable for radial loads. Lower bearing shall be capable of taking axial load in either direction as well as radial load to counter the moment on the shaft. Shafts utilizing mechanical coupling shall not be allowed. Shaft shall be –ASTM A479 S43100-T stainless steel.

7.15 MOTOR: Motor shall be an explosion-proof NEMA B design and shall be inverter duty rated in accordance with NEMA MG1, Part 31 design. Motor shall be in a watertight chamber. Windings shall have insulation class H or better rated for 356°F. Stator shall be insulated by the trickle impregnation method resulting in a winding fill factor of 95%. Motor must be designed specifically for submersible pump usage (water tight). Motor shall be non-overloading for the entire range of the operating curve within the name plate H and shall be capable of no less than 15 evenly spaced starts per hour. A performance chart shall be provided showing curves for torque, current, a minimum service factor of 1.15, input/output kW and efficiency. Motor shall be sized to be non-overloading throughout the entire performance curve to include shut-off to run-off. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The motor shall be capable of continuous submergence under pumped media to a depth of 65 feet or greater. The motor shall be able to operate dry without damage while pumping under load.

7.16 SEAL: Each pump shall be provided with a tandem mechanical shaft seal system. The upper seal set shall contain one stationary tungsten-carbide ring and positively driven rotating tungsten ring and functions as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal shall function as the primary barrier between the pumped liquid and the oil housing. This set shall contain one stationary tungsten-carbide ring and positively driven rotating tungsten ring. Seal lubricant shall be FDA approved non-toxic. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely on the pumped media for lubrication.

7.17 CABLE: Cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need for splicing. The out jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous under pumped media submergence to a depth of 65 feet or greater.

7.18 PROTECTION: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped in the end of the coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. The pump shall be equipped with moisture sensors in the oil filled seal chamber to indicate seal leakage. The thermal switches shall open at 260°F, stop the motor and active an alarm.

7.19 COOLING: Cooling jacket shall be provided to allow pump to be cooled while water level is at the top of volute. The cooling system shall provide continuous pump operation in liquid or ambient temperatures of 104°F.

7.20 ENVIRONMENT: Pump needs to be able to withstand wastewater conditions. Pump, motor and cable shall be designed for continuous submersible use without loss of water tight integrity.

7.21 DELIVERY

7.1.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

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7.1.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

7.1.3 The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

7.1.4 Final Delivery details should also be coordinated with Mr. Daffy Burroughs, WWTP Maintenance, Operations Branch, 77051 (Phone # 832-341-7175).

7.22 TOOLS AND SPARE PARTS

7.23 Kellems Grips shall be provided

7.24 O&M (Operations and Maintenance manuals).

7.25 WARRANTY

7.26 The manufacturer shall provide the following to the owner:

7.27 One (1) year warranty from the date of final system acceptance.

7.28 MANUFACTURERS/VENDOR SERVICES

The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

Provide complete training and local service capability for a period of not less than one half day.

Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

8.0 LINE ITEM NO. 8 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. 3531 or City Approved Equal

8.1 SUMMARY OF REQUIREMENT:

8.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

8.1.2 The pump shall be rated for wastewater applications.

8.1.3 Requirements for providing a submersible wastewater lift station pump and monitoring system at Upperbraes Wastewater Treatment Plant capable of protecting the pump in case of failure, transmit warnings and alarms to operations personnel and record pump operating data for historical record keeping.

8.1.4 Requirements for providing a submersible wastewater lift station pump and monitoring system at Upperbraes Wastewater Treatment Plant capable of protecting the pump in case of failure, transmit warnings and alarms to operations personnel and record pump operating data for historical record keeping.

8.2 DESIGN REQUIREMENTS

8.3 The submersible pump and monitoring/controller unit specified in this section will be used to pump raw, unscreened wastewater.

8.4 Operating Flow (Required)	9000 GPM @75 TDH
8.5 Second duty point	12,700 GPM @ 62 TDH
8.6 Voltage	4160
8.7 (2) Power Cables	100 feet each, sized according to NEC and ICEA standards
8.8 Frequency	60 Hz
8.9 Discharge size	20 inch
8.10 Discharge configuration required	KSB discharge elbow
8.11 PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

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- 8.12 CASING and VOLUTE: Pump castings shall be cast iron conforming to ASTM A48, Class 30 or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Surfaces coming into contact with sewage, other than stainless steel shall be protected by an approved sewage resistant coating. Mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber o-rings. Fittings shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. No secondary sealing compounds, rectangular gaskets, elliptical o-rings, grease or other devices shall be used. Pump supplier shall supply an adaptor for the pump to work with the existing KSB guide cable system. The adaptor shall bolt to the pump discharge, and connect to the existing discharge elbow. The bracket shall carry the entire weight of the pump. The bracket shall be stainless steel and arrive mounted to the pump and include all SS bolts and gaskets as required. Specifications for KSB bracket are unavailable. Upon request City of Houston will coordinate access to the lift station's KSB guide cable system, material and parts with vendor. Vendor is to use this information, material and parts to fabricate the required bracket.
- 8.13 IMPELLERS: The pump impeller shall be non-clog designed with smooth passage to pass liquid, solids of at least 3 inches and prevent clogging of stringy, fibrous material. The impeller material type made of cast iron conforming to ASTM 536 Grade 64-45-12 ductile iron. Rotation of the impeller shall be secured via a shaft key or other locking mechanism.
- 8.14 WEAR RINGS: Shall be furnished with the volute and impeller. They must be fully adjustable and easily replaceable. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
- 8.15 BEARINGS AND SHAFTS: Bearings must be permanently lubricated and the minimum L₁₀ bearing life shall be 100,000 hours at the best efficiency point. Inboard bearing shall be suitable for radial loads. Outboard bearing shall be capable of taking axial load in either direction as well as radial load to counter the moment on the shaft.
- 8.16 MOTOR: The frequency of the motor shall be 60 hertz and winding shall be insulation class H or better. Motor must be designed specifically for submersible pump usage. Motor shall be non-overloading for the entire range of the operating curve within the name plate HP.
- 8.17 PROTECTION- As a minimum, all stators shall incorporate three thermal switches (one switch for each phase), connected in series, to provide over temperature protection of the motor winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm. The stator shall also include one PT-100 type temperature probe to provide for monitoring of the stator temperature
- 8.18 A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.
- 8.19 Two leakage sensors shall be provided to detect water intrusion into the stator chamber and junction chamber. A Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in either the stator chamber or junction chamber. When activated, the FLS will stop the motor and activate an alarm. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS SHALL NOT BE ALLOWED.
- 8.20 Sensors should be located in the areas below:
- 8.28.1 Three (3) thermal switches embedded in the stator windings
 - 8.28.2 One (1) RTD sensor in the stator windings
 - 8.28.3 One (1) RTD sensor on the pump main bearing
 - 8.28.4 One (1) moisture leakage sensor in pump stator housing
 - 8.28.5 One (1) moisture leakage sensor in motor connection housing
 - 8.28.6 One (1) temperature sensor in pump connection housing
 - 8.28.7 Monitoring of pump current in one (1) phase
 - 8.28.8 One (1) vibration sensor in pump connection housing

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8.21 CONTROL and MONITORING UNIT-The solid-state pump memory unit, three thermal switches, two FLS switches, PT-100 stator temperature monitor and the lower bearing PT-100 temperature monitor shall all be connected to a Monitoring and Status unit. The control unit shall be designed to be mounted in the control panel and shall come with an Operator Panel that is dead-front panel mounted. The Operator Panel shall have soft-touch operator keys and provide local indication of the status of the alarms within the connected pump unit by means of an LCD screen read-out. Local CONTROL system change shall be made by use of the soft-touch keypad or local connection by means of a laptop computer. Remote indication of pump unit status shall be possible with connection to customer PLC or via LAN.

8.22 The base unit shall provide the ability to adjust trip points of each value sensed, and to designate specific alarm actions: either provides warning or shutdown pump. The base unit shall include three (3) relay contacts to provide annunciation of warning (NO/NC), annunciation of alarm (NO/NC), and to shut down the pump (NC).

8.23 The pump monitoring system shall be capable of providing historical data of pump sensor information and present it in trend-chart

8.24 COOLING: Cooling jacket shall be provided to allow pump to be cooled while water level is at the top of volute.

8.25 ENVIRONMENT: Pump needs to be able to withstand wastewater conditions. Fluid to be pump is raw unscreened wastewater. Pump, motor and cable shall be designed for continuous submersible use without loss of water tight integrity.

8.26 DELIVERY

8.26.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

8.26.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

8.26.3 The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

8.26.4 Final Delivery details should also be coordinated with Mr. Gurdip Hyare, Managing Engineer, Plant Operations, Wastewater Operations Branch, 2525 S/Sgt. Macario Garcia, Houston, Texas 77020 (69th St WWTP, Phone # 832-395-5459).

8.27 TOOLS AND SPARE PARTS

8.27.1 Kellems Grips shall be provided

8.27.2 78 feet stainless steel lifting cable

8.27.3 Additional 100 feet of power cable sized according to NEC and ICEA standard. Additional power cable is to be delivered with pump.

8.27.4 O&M (Operations and Maintenance manuals).

8.28 WARRANTY

8.28.1 The manufacturer shall provide the following to the owner:

8.28.2 Five (5) year warranty from the date of final system acceptance.

8.29 MANUFACTURERS/VENDOR SERVICES

- 8.29.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following:
- 8.29.2 Provide complete training and local service capability for the entire monitoring system and pump for a period of not less than one half day.
- 8.29.3 Be present during installation of pump and perform installation of monitoring and control unit. Inspect the system prior to delivery, supervise the City of Houston during start up and testing of the system, and certify the system has been properly furnished and is ready for operation.
- 8.29.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

9.0 **LINE ITEM NO. 9 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE**

Make: Flygt

Model: Model No. NP 3127.095-0012 or City Approved Equal

9.1 **SUMMARY OF REQUIREMENT:**

- 9.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.
- 9.1.2 The pump shall be rated for wastewater applications.
- 9.1.3 The City of Houston intends to procure Scum Pumps for its Northeast Wastewater Treatment Plant (WWTP). The proposed new pumps are to replace the old Scum Pumps, Flygt NP-3127.095-0012 currently installed at the Northeast WWTP. However, equivalent pumps from other vendors could be acceptable. Therefore, prospective vendors are encouraged to visit the site to make sure that the pumps they offer will fit the existing location, with NO modifications to the existing structures and systems.
- 9.1.4 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 9.1.5 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is equal or superior to Flygt Model NP-3127.095-0012 Scum Pumps currently installed at the Northeast WWTP, as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation for each deviation or substitution.
- 9.1.6 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for clarification to the specifications shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum, in accordance with Local Public Contract Laws.
- 9.1.7 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein.
- 9.1.8 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.
- 9.1.9 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO – PRODUCT/DESIGN REQUIREMENTS

9.2 The submersible pump specified in this section will be used to pump scum received from the Clarifier Scum box to the headworks.

9.2.1 Pump

9.2.2 The 6-inch discharge, electric submersible scum pumps should be reliable and efficient for wastewater handling, and should maintain efficiency even with high solids. The pumps should reduce the risk of clogging, even under the worst conditions.

9.2.2.1. Design Flow : 800 gpm @ 33 ft TDH

9.2.2.2. Pump and motor submersible

9.2.2.3. Pump discharge size 6-inch

9.2.2.4. Pump shall be constructed of metal capable of withstanding full submersion in corrosive environments and conditions as typically experienced in Wastewater.

9.2.2.5. Pump Impeller shall be manufactured from a corrosion resistant material or coated with a corrosive resistant coating to prolong life and reduce wear.

9.2.2.6. Pump Impeller shall be dynamically balanced.

9.2.2.7. Pump shall be equipped with mounting brackets to allow connection onto existing pump mounts.

9.2.3 Motor

9.2.3.1. Rated at 10 HP, 460 volts, 3 phase, 60 hertz, 1735 RPM, with 50' of 7- conductor SPC cable.

9.2.3.2. Squirrel cage, high performance induction motor.

9.2.3.3. Specially designed and manufactured for submersible use in wastewater.

9.2.3.4. Stator windings are impregnated in resin to class H insulation and rated at 180 degree C (355 degree F).

9.2.3.5. Must be explosion proof.

9.2.3.6. Thermal sensors embedded in the stator windings to help prevent overheating.

9.2.3.7. Shall comply with NEMA standard MG-1

9.2.3.8. Combined service factor (combined effect of voltage, frequency) shall be a minimum of 1.15.

9.2.3.9. Motor shall have NEMA PREMIUM electrical efficiency or equivalent

Voltage tolerance shall be, typically no less than 10% and no more than 5% from its voltage rating.

9.2.3.10. Motor shall be fully compatible and be able to function as intended when connected to the existing switchgear and infrastructure.

PART THREE - EXECUTION

9.3 MANUFACTURERS/VENDOR SERVICES

9.3.1 The manufacturer shall furnish the services of a competent factory representative to do the following:

9.3.1.1 Inspect the system prior to delivery, supervise the City of Houston start up and testing of the system, and certify the system has been properly furnished and is ready for operation.

9.3.1.2 Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.

9.3.1.3 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

9.4 TOOLS AND SPARE PARTS

9.4.1 The manufacturer shall provide the following to the owner:

9.4.2 Tools and spare parts for at least one year.

9.4.3 At least two copies of the the Operations and Maintenance Manual.

9.5 WARRANTY

9.5.1 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start up which ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

9.5.2 The vendor and/or the manufacturer shall allow the City the option to purchase an extended warranty.

9.6 DELIVERY

9.6.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7440 Cullen Blvd, Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

9.6.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

9.6.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

9.6.4 Final Delivery details should also be coordinated with Mr. Gurdip Hyare, Managing Engineer, Plant Operations, Wastewater Operations Branch, 2525 S/Sgt. Macario Garcia, Houston, Texas 77020 (69th St WWTP, Phone # 832-395-5459).

10.0 LINE ITEM NO. 10 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. CP 3531X or City Approved Equal

10.1 SUMMARY OF REQUIREMENT:

- 10.1.1. The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the Sims South WWTP.
- 10.1.2. The pump shall be rated for wastewater applications.
- 10.1.3. Requirements for providing a Return Activated Sludge Pump for the Sims South WWTP.
- 10.1.4. **GENERAL:** The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 10.1.5. **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved direct replacement of the Return Activated Sludge Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 10.1.6. **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 10.1.7. **GENERAL SPECIFICATIONS:** The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.
- 10.1.8. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 10.1.9. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCTS

10.2 REQUIREMENTS

- 10.2.1. Submersible non-clog wastewater pump
- 10.2.2. Closed coupled explosion proof
- 10.2.3. Horsepower: 170 HP (City will consider 135 HP)
- 10.2.4. Submersible electric motor connected for operation on 460 volts, 3 phase, 60 HZ, 900 RPM,
- 10.2.5. 4 wire service with 85 linear feet of submersible cable (SUBCAB) suitable for submersible pump applications. Sized according to NEC and ICEA standards.
- 10.2.6. 80 linear feet of multi-conductor submersible cable (SUBCAB) will be used to convey pump monitoring device signals.

10.3 DEISGN CONFIGURATION

- 10.3.1. Mating cast iron 20 inch discharge connection
- 10.3.2. 11,000 GPM at 36 feet TDH
- 10.3.3. Pump efficiency: 87.5%
- 10.3.4. NPSH: 23 feet
- 10.3.5. Premium efficiency motor efficiency: 88.5% minimum
- 10.3.6. Shut Off Head: 76 feet minimum
- 10.3.7. The pump shall be automatically and firmly connected to the discharge connection, guided by no led than two guide bars extending from the top of the station to the discharge connection.
- 10.3.8. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal water tight contact.
- 10.3.9. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be accepted.
- 10.3.10. No portion of the pump shall bear directly on the sump floor.
- 10.3.11. Pump shall be capable of operating on a continuous non submerged condition in a dry pit installation.

10.4 PUMP CONSTRUCTION

- 10.4.1. Component Material: Gray cast iron, ASTM A 48, Class 35B with smooth surfaces devoid of blow holes or other casting irregularities.
- 10.4.2. Exposed Nuts and Bolts: 316 stainless steel construction.
- 10.4.3. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- 10.4.4. Sealing: shall incorporate metal to metal contact between machine surfaces. Pump/motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O rings. Joint sealing will be the result of controlled compression of rubber O –rings in two planes and O-ring contact on four sides without the requirement of a specific bolt torque limit.
- 10.4.5. Rectangular cross sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal.
- 10.4.6. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

10.5 COOLING SYSTEM

- 10.5.1 Each unit shall be provided with an integral motor cooling system.
- 10.5.2 A motor cooling jacket shall encircle the stator housing providing for dissipation of motor heat regardless of the type of pump instillation.
- 10.5.3 An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket.
- 10.5.4 The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer.
- 10.5.5 The cooling system shall have one fill port and one drain port integral to the cooling jacket.
- 10.5.6 The cooling system shall provide continuous pump operation in liquid or ambient temperatures of up to 104 degrees Fahrenheit (40 degrees Celsius).
- 10.5.7 Operational restrictions at temperatures below 104 degrees Fahrenheit are not acceptable.
- 10.5.8 Fans, blowers or auxiliary cooling systems that are mounted external tot e pump motor are not acceptable.

10.6 CABLE ENTRY SEAL

- 10.6.1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal.
- 10.6.2. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter.
- 10.6.3. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function.
- 10.6.4. The assembly shall provide ease of changing the cable when necessary using the same entry seal.
- 10.6.5. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top.
- 10.6.6. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

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10.7 MOTOR

- 10.7.1 The pump motor shall be an **Explosion-Proof** motor of NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.
- 10.7.2 The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.
- 10.7.3 The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.
- 10.7.4 The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
- 10.7.5 The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour.
- 10.7.6 The rotor bars and short circuit rings shall be made of cast aluminum. Pumps using 9xx series drive units are capable of 15 evenly spaced starts per hour.
- 10.7.7 Three embedded thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. 2.6.8
- 10.7.8 One PT-100 type temperature sensor shall be installed in the stator winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.
- 10.7.9 The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals.
- 10.7.10 A mechanical float switch (FLS) shall be mounted in the junction chamber to signal if there is water intrusion.
- 10.7.11 A pump memory module shall be provided and mounted in the junction chamber to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history.
- 10.7.12 The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
- 10.7.13 The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.
- 10.7.14 A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no load characteristics.
- 10.7.15 The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
- 10.7.16 The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut off through run out.

10.8 PILOT CABLE

- 10.8.1 The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (SUBmersible CABLE).
- 10.8.2 The cable shall be multi-conductor type with stainless steel braided shielding, a chlorinated polyethylene rubber outer jacket and tinned copper conductors insulated with ethylene-propylene rubber.
- 10.8.3 The conductors shall be arranged in twisted pairs.
- 10.8.4 The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature and shall be approved by Factory Mutual (FM).
- 10.8.5 The cable length shall be adequate to reach the junction box without the need for splices.

10.9 BEARINGS

- 10.9.1 The pump shaft shall rotate on at least three grease-lubricated bearings.
- 10.9.2 The upper bearing, provided for radial forces, shall be a single roller bearing.

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- 10.9.3 The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.
- 10.9.4 The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.
- 10.9.5 The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

10.10 MECHANICAL SEAL

- 10.10.1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring.
- 10.10.2. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring.
- 10.10.3. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring.
- 10.10.4. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber.
- 10.10.5. All seal rings shall be individual solid sintered rings (metallurgical fuses the particles without melting them or gluing them).
- 10.10.6. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing.
- 10.10.7. Mounting of the lower seal on the impeller hub is not acceptable.
- 10.10.8. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable.
- 10.10.9. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
- 10.10.10. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
- 10.10.11. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.
- 10.10.12. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

10.11 PUMP SHAFT

- 10.11.1 Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft.
- 10.11.2 Pieced shafts or the use of couplings shall not be acceptable.
- 10.11.3 The pump shaft shall be of AISI 431 stainless steel and shall be completely isolated from the pumped liquid.

10.12 IMPELLER

- 10.12.1 **Shall be NO. 1040**
The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, multiple vaned, double shrouded non clogging design having long throughlets without acute turns.
- 10.12.2 The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
- 10.12.3 Impeller(s) shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing

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a minimum 4.13 inch diameter solid.

- 10.12.4 All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

10.13 WEAR RINGS

- 10.13.1 A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
10.13.2 Each pump shall be equipped with a brass ring insert that is drive fitted to the volute inlet.
10.13.3 This pump shall also have a stainless steel impeller wear ring heat shrink fitted onto the suction inlet of the impeller.

10.14 VOLUTE

- 10.14.1 Pump volute(s) shall be single piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller.
10.14.2 Minimum inlet and discharge size and flange connections shall match field conditions.

10.15 PROTECTION

- 10.15.1 All stators shall incorporate three thermal switches, connected in series, to provide over temperature protection of the motor winding.
10.15.2 Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.
10.15.3 The stator shall also include one PT-100 type temperature probe to provide for monitoring of the stator temperature.
10.15.4 A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.
10.15.5 Two leakage sensors shall be provided to detect water intrusion into the stator chamber and junction chamber.
10.15.6 A Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in either the stator chamber or junction chamber. When activated, the FLS will stop the motor and activate an alarm. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS SHALL NOT BE ALLOWED.
10.15.7 All protection devices shall work with the existing pump protection module installed in the existing control.

PART THREE - EXECUTION

10.16 DELIVERY

- 10.16.1 Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen Houston TX, 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
10.16.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
10.16.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
10.16.4 Final Delivery details should also be coordinated with Gurdip Hyare (Phone # 832-395-5459).

10.17 TOOLS AND SPARE PARTS

- 10.17.1 (4) Operations and Maintenance manuals.

10.18 WARRANTY

- 10.18.1 The manufacturer shall furnish the following to the owner:
10.18.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days

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after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

11.0 LINE ITEM NO. 11 PUMP, ELECTRICAL, SLUDGE PUMP

Make: Flygt

Model: Model No. NP 3127.090 or City Approved Equal

11.1 SUMMARY OF REQUIREMENT:

- 11.1.1. The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.
- 11.1.2. The pump shall be rated for wastewater applications.
- 11.1.3. Requirements for providing electrically Submersible Wet Pit Pumps (Scum Pumps) for the Northeast WWTP scum pit, 655 Maxey Rd. Houston, TX 77013.
- 11.1.4. **GENERAL:** The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 11.1.5. **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved substitute to a Flygt, Electric Submersible Non-Clog Pumps (Model: NP 3127.090, 10 HP, 460 V, with 50' Power Cables, as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require a reply with an explanation at each deviation or substitution.
- 11.1.6. **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 11.1.7. **GENERAL SPECIFICATIONS:** Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.
- 11.1.8. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.
- 11.1.9. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.
- 11.1.10. **Requirement:** Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a 10 HP submersible electric Explosion-Proof motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire service. The motor must be voltage changeable to 230 volt by a simple wiring change. The pump will be supplied with 50 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing 4 inch Flygt Corporation discharge connection with no modification or extra cost to the City. The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of

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530 GPM at 49 TDH. The pump shall operate at the design condition with an efficiency of 73.4 % without vibration or cavitation. The pump shall also be able to operate 700 GPM at 38 feet total head without vibration or cavitation. Shut off head shall be 84 feet (minimum).

11.1.11. DESIGN REQUIREMENT: The pump must be able to be capable of being installed in dry pit application with no modification and be rated for continuous duty in a completely dry environment.

11.1.12. The pumps shall be capable of being used in a portable configuration.

11.1.13. **Pump Construction:** Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

11.1.14 Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

11.1.15 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

11.1.16 **Cooling System:** Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

11.1.17 GENERAL SYSTEM DESCRIPTION: PERFORMANCE REQUIREMENTS

OPERATING CONDITIONS	N/A GPM @ N/A TDH
MINIMUM SHUTOFF HEAD	84 FT
MAXIMUM MOTOR HP	10 HP
MINIMUM HYDRAULIC EFF. (@ Design)	N/A
MAXIMUM MOTOR RPM	1720 RPM
FULL LOAD AMPS	N/A
VOLTAGE	460 VOLTS 60 HZ
SOLID DIAMETER	3 IN
SUCTION SIZE : 4 INCH DISCHARGE SIZE: 4 INCH	
PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

PART TWO - PRODUCTS

11.2 EQUIPMENT / ACCESSORIES:

11.2.1 **POWER CABLE:** Provide 50 ft. of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/ terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

11.2.2 **TEMPERATURE PROTECTION:** All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

- 11.2.3 **SEAL LEAK DETECTION:** A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.

The thermal switches and FLS shall be connected to the existing Mini CAS (Control and Status) monitoring unit.

Note: FLS not available in NZ configuration.

- 11.2.4 **IMPELLER :** The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges that are hardened to Rc 45 and shall be capable of handling solids, fibrous materials, and other matter found in waste water and sludge with up to 7% solids. Impellers shall be locked to the shaft and held by an impeller bolt.
- 11.2.5 **SHAFT:** Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel- ASTM A479 S43100-T. If a shaft material of lower quality than stainless steel-ASTM A479 S43100-T is used, a shaft sleeve of stainless steel ASTM A479 S43100-T is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless steel sleeves will not be considered equal to stainless steel shafts.
- 11.2.6 **SHAFT SEAL:** Provide a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals should operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant **tungsten-carbide** ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant **tungsten-carbide** seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor **depend on direction of rotation for sealing**. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.
- 11.2.7 **BEARINGS:** The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces.
- 11.2.8 **MOTOR:** The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage

tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

- 11.2.9 **Requirement:** Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a 10 HP submersible electric Explosion-Proof motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire service. The motor must be voltage changeable to 230 volt by a simple wiring change. The pump will be supplied with 50 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing 4 inch Flygt Corporation discharge connection with no modification or extra cost to the City. The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of 530 GPM at 49 TDH. The pump shall operate at the design condition with an efficiency of 73.4 % without vibration or cavitation. The pump shall also be able to operate 700 GPM at 38 feet total head without vibration or cavitation. Shut off head shall be 84 feet (minimum).

PART THREE - EXECUTION

11.3 DELIVERY

- 11.3.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 11.3.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 11.3.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 11.3.4 Vendor shall be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.
- 11.3.5 Final Delivery details should also be coordinated with Mr. Arturo Carrillo, 7440 Cullen, Houston, Texas 77051 (Phone # 832-395-3558).
- 11.3.6 Estimated delivery is 8 to 10 weeks after receipt of written purchase order and approval drawings, if applicable.

11.4 Terms of Payment

- 11.4.1 1% 10days/net 30 days, with approved credit.

12.0 LINE ITEM NO. 12 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flygt

Model: Model No. NS 3127 or City Approved Equal

12.1 SUMMARY OF REQUIREMENT:

12.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

12.1.1 The pump shall be rated for wastewater applications.

12.2 Furnish submersible non-clog wastewater pumps. Each pump shall be equipped with a **10** ___ HP submersible electric motor, connected for operation on **230 and 460 volts, 3 phase**, 60 hertz, **4** ___ wire service, with **50** feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing **6** inch Flygt Corporation discharge connection with no modification or extra cost to the City. **The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of 800 GPM at 35 TDH.** The pump shall operate at the design condition with an efficiency of **77.3 %**. **The pump shall also be able to operate 1300 GPM at 15 feet total head with out vibration or cavitations. Shut off head shall be 66 feet (minimum).**

12.3 The pump must be able to be installed in dry pit application **with no modification** and be rated for **continuous duty in a completely dry environment.**

12.4 PUMP DESIGN

12.4.1 The pumps shall be capable of being used in a portable configuration or with a Flygt guide rail configuration with existing discharge connections.

12.5 PUMP CONSTRUCTION

12.5.1 Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

12.5.2 Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

12.5.3 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

12.6 COOLING SYSTEM

12.6.1 Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

12.7 MOTOR

- 12.7.1 The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.
- 12.7.2 The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
- 12.7.3 The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.
- 12.7.4 Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

12.8 BEARINGS

- 12.8.1 The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L₁₀ bearing life shall be 50,000 hours at any usable portion of the pump curve.

12.9 MECHANICAL SEALS

- 12.9.1 Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
- 12.9.2 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
- 12.9.3 The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

12.9.4 A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

12.10 PUMP SHAFT

12.10.1 The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

12.11 IMPELLER

12.11.1 The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

12.12 VOLUTE/SUCTION COVER

12.12.1 The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged groove(s) that is cast into the suction cover. The spiral groove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

12.13 PROTECTION

12.13.1 Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

12.13.2 The thermal switches and float switch shall be connected to the existing Mini CAS control and status monitoring unit. If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.

13.0 LINE ITEM NO. 13 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flygt

Model: Model No. NS 3153 or City Approved Equal

13.1 SUMMARY OF REQUIREMENT:

13.1.1 The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.

13.1.2 The pump shall be rated for wastewater applications.

13.2 Furnish 6 submersible non-clog wastewater pumps. Each pump shall be equipped with a 20 HP submersible electric motor, connected for operation on 230 and 460 volts, 3 phase, 60 hertz, 4 wire service, with 50 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be capable of operating with existing 6 inch Flygt Corporation discharge connection with no modification or extra cost to the City. **The pump shall be supplied with a drilled flanges and a stand for portable use. The pump shall be capable of delivering the design condition of 1080 GPM at 54 TDH.** The pump shall operate at the design condition with an efficiency of 81.4 %. **The pump shall also be able to operate 1880 GPM at 25 feet total head with out vibration or cavitations. Shut off head shall be 94 feet (minimum).**

13.3 The pump must be able to be installed in dry pit application with no modification and be rated for continuous duty in a completely dry environment.

13.4 PUMP DESIGN

13.4.1 The pumps shall be capable of being used in a portable configuration or with a Flygt guide rail configuration with existing discharge connections.

13.5 PUMP CONSTRUCTION

13.5.1 Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

13.5.2 Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

13.5.3 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

13.6 COOLING SYSTEM

13.6.1 Each unit shall be provided with an integral motor cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F. (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

13.7 MOTOR

- 13.7.1 The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable.
- 13.7.2 The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.
- 13.7.3 The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
- 13.7.4 The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.
- 13.7.5 Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

13.8 BEARINGS

- 13.8.1 The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L₁₀ bearing life shall be 50,000 hours at any usable portion of the pump curve.

13.9 MECHANICAL SEALS

- 13.9.1 Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
- 13.9.2 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

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- 13.9.3 The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.
- 13.9.4 A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

13.10 PUMP SHAFT

- 13.10.1 The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

13.11 IMPELLER

- 13.11.1 The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

13.12 VOLUTE/SUCTION COVER

- 13.12.1 The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged groove(s) that is cast into the suction cover. The spiral groove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

13.13 PROTECTION

- 13.13.1 Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.
- 13.13.2 **The thermal switches and float switch shall be connected to the existing Mini CAS control and status monitoring unit.** If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.

14.0 LINE ITEM NO. 14 PUMP, ELECTRICAL, SUBMERSIBLE SEWAGE

Make: Flyght

Model: Model No. NP 3153 or City Approved Equal

14.1 SUMMARY OF REQUIREMENT:

- 14.1.1. The Contractor shall be required to provide **the pump** as specified in this section. The pump(s) bid/furnished and delivered by the contractor shall require no structure and/or piping alterations/modifications. The pump and motor as specified will be used by the City to pump activated sludge at the City's Southwest Wastewater Treatment Plant.
- 14.1.2. The pump shall be rated for wastewater applications.
- 14.1.3. The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 14.1.4. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of the Submersible Lift Station Pumps as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 14.1.5. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 14.1.6. GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.
- 14.1.7. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 14.1.8. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCTS

14.2 REQUIREMENTS

- 14.2.1. Submersible non-clog wastewater pump
- 14.2.2. Horsepower: 20 HP
- 14.2.3. Submersible electric motor connected for operation on 460 volts, 3 phase, 60 HZ
- 14.2.4. Wire service with 50 linear feet of submersible cable (SUBCAB) suitable for submersible pump applications. Sized according to NEC and ICEA standards.
- 14.2.5.** The pumps shall be capable of having the motor voltage changed to 230 volts by a simple wiring change in the pump junction chamber.

14.3 DEISGN CONFIGURATION (WET PUMP INSTILLATION)

- 14.3.1. Capable of mating to the existing cast iron 8 inch discharge connection
- 14.3.2. 1200 GPM at 43 feet TDH
- 14.3.3. Pump efficiency: 82.7%
- 14.3.4. NPSH: 12.9
- 14.3.5. Premium efficiency motor efficiency: 93.5% minimum
- 14.3.6. An additional point on the same curve shall be 8000 GPM at 54 feet total head
- 14.3.7. Shut Off Head: 78 feet minimum
- 14.3.8. The pump shall be automatically and firmly connected to the discharge connection, guided by no led than two guide bars extending from the top of the station to the discharge connection.
- 14.3.9. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal water tight contact.
- 14.3.10. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be accepted.
- 14.3.11. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump shall bear directly on the sump floor.
- 14.3.12. Pump shall be capable of operating on a continuous non submerged condition in a horizontal or vertical position in a dry pit installation.

14.4 PUMP CONSTRUCTION

- 14.4.1. Component Material: Gray cast iron, ASTM A 48, Class 35B with smooth surfaces devoid of blow holes or other casting irregularities.
- 14.4.2. Exposed Nuts and Bolts: stainless steel construction.
- 14.4.3. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- 14.4.4. Sealing: shall incorporate metal to metal contact between machine surfaces. Pump/motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O rings. Joint sealing will be the result of controlled compression of rubber O –rings in two planes and O-ring contact on four sides without the requirement of a specific bolt torque limit.
- 14.4.5. Rectangular cross sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal.
- 14.4.6. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

14.5 COOLING SYSTEM

- 14.5.1. Each unit shall be provided with an integral motor cooling system.
- 14.5.2. A motor cooling jacket shall encircle the stator housing providing for dissipation of motor heat regardless of the type of pump instillation.
- 14.5.3. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket.
- 14.5.4. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer.
- 14.5.5. The cooling system shall have one fill port and one drain port integral to the cooling jacket.
- 14.5.6. The cooling system shall provide continuous pump operation in liquid or ambient temperatures of up to 104 degrees Fahrenheit (40 degrees Celsius).
- 14.5.7. Operational restrictions at temperatures below 104 degrees Fahrenheit are not acceptable.
- 14.5.8. Fans, blowers or auxiliary cooling systems that are mounted external tot e pump motor are not acceptable.

14.6 CABLE ENTRY SEAL

- 14.6.1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal.
- 14.6.2. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter.

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- 14.6.3. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function.
- 14.6.4. The assembly shall provide ease of changing the cable when necessary using the same entry seal.
- 14.6.5. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top.
- 14.6.6. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

14.7 MOTOR

- 14.7.1. The pump motor shall be an **Explosion-Proof** motor of NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.
- 14.7.2. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.
- 14.7.3. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.
- 14.7.4. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
- 14.7.5. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour.
- 14.7.6. The rotor bars and short circuit rings shall be made of cast aluminum.
- 14.7.7. The motor shall be capable of withstanding 15 evenly spaced starts per hour.
- 14.7.8. Thermal switches shall be embedded in the stator end coils to monitor the temperature, one per phase winding to monitor stator temperature.
- 14.7.9. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.
- 14.7.10. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals.
- 14.7.11. A mechanical float switch (FLS) shall be mounted in the junction chamber to signal if there is water intrusion.
- 14.7.12. A pump memory module shall be provided and mounted in the junction chamber to record pump run time, number of starts as well as contain the motor unit performance and manufacturing data and service history.
- 14.7.13. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
- 14.7.14. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.
- 14.7.15. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no load characteristics.
- 14.7.16. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
- 14.7.17. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut off through run out.

14.8 PILOT CABLE

- 14.8.1. The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (SUBmersible CABLE).

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- 14.8.2. The cable shall be multi-conductor type with stainless steel braided shielding, a chlorinated polyethylene rubber outer jacket and tinned copper conductors insulated with ethylene-propylene rubber.
- 14.8.3. The conductors shall be arranged in twisted pairs.
- 14.8.4. The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature and shall be approved by Factory Mutual (FM).
- 14.8.5. The cable length shall be adequate to reach the junction box without the need for splices.

14.9 BEARINGS

- 14.9.1. The pump shaft shall rotate on two bearings.
- 14.9.2. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease.
- 14.9.3. The upper bearing, provided for radial forces, shall be a single roller bearing.
- 14.9.4. The lower bearings shall be a two row angular contact ball roller bearing to handle the thrust and radial loads.
- 14.9.5. The minimum L10 bearing life shall be 50,000 hours at any point along the usable portion of the pump curve at maximum product speed.
- 14.9.6. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

14.10 MECHANICAL SEAL

- 14.10.1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring.
- 14.10.2. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring.
- 14.10.3. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring.
- 14.10.4. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber.
- 14.10.5. All seal rings shall be individual solid sintered rings (metallurgical fuses the particles without melting them or gluing them).
- 14.10.6. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing.
- 14.10.7. Mounting of the lower seal on the impeller hub is not acceptable.
- 14.10.8. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable.
- 14.10.9. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
- 14.10.10. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
- 14.10.11. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

14.11 PUMP SHAFT

- 14.11.1. Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft.
- 14.11.2. Pieced shafts or the use of couplings shall not be acceptable.
- 14.11.3. The pump shaft shall be of AISI 431 stainless steel and shall be completely isolated from the pumped liquid.

14.12 IMPELLER

- 14.12.1. The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, multi- vane, double shrouded non clogging design.
- 14.12.2. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as the pass across a spiral groove located on the volute suction.
- 14.12.3. The screw shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater.
- 14.12.4. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater.
- 14.12.5. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw.
- 14.12.6. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

14.13 WEAR RINGS

- 14.13.1. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
- 14.13.2. Each pump shall be equipped with a brass ring insert that is drive fitted to the volute inlet.
- 14.13.3. This pump shall also have a stainless steel impeller wear ring heat shrink fitted onto the suction inlet of the impeller.

14.14 VOLUTE/SUCTION COVER

- 14.14.1. Pump volute(s) shall be single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller.
- 14.14.2. Minimum inlet and discharge size and flange connections shall match field conditions.
- 14.14.3. The volute shall have integral spiral-shaped, sharpened-edged groove(s) that is cast into the suction q cover.
- 14.14.4. The spiral grove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed.
- 14.14.5. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

14.15 PROTECTION

- 14.15.1. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor.
- 14.15.2. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.
- 14.15.3. The thermal switches and float switch shall be connected to the existing Mini CAS control and status monitoring unit.
- 14.15.4. If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.

PART THREE - EXECUTION

14.16 DELIVERY

- 14.16.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen Houston TX, 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 14.16.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 14.16.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 14.16.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

14.17 TOOLS AND SPARE PARTS

14.17.1 (4) Operations and Maintenance manuals.

14.18 WARRANTY

14.18.1. The manufacturer shall furnish the following to the owner:

14.18.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

15.0 LINE ITEM NO. 15 PUMP, BARE

Make: ITT Goulds

Model: Model No. NSWV 10x10x21LC or City Approved Equal

15.1 SUMMARY OF REQUIREMENT:

- 15.1.1. Requirements for providing an East RAS Station Vertical Centrifugal Dry Pit Pump for Sims North WWTP.
- 15.1.2. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 15.1.3. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 15.1.4. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 15.1.5. GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.
- 15.1.6. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 15.1.7. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCTS

15.2 REQUIREMENTS

- 15.2.1. Centrifugal Pump
- 15.2.2. Shall be a direct replacement for existing pump(s) with no modification to existing structure, frame, or pump mounts.
- 15.2.3. If pumps are supplied that will not operate with the existing monitoring unit, the pump supplier shall have an electrician approved by the City of Houston with the proper insurance and licenses, install the proper monitoring units at no cost to the City.
- 15.2.4. Flow: 2800 GPM
- 15.2.5. Speed: 575 RPM
- 15.2.6. Horsepower: 20hp.

15.3 CASING

- 15.3.1. Shall be close-grained cast iron ASTM A48 Class 30 of sufficient strength, weight and metal thickness to insure long life, accurate alignment, and reliable operation.
- 15.3.2. Volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow.
- 15.3.3. A large clean-out opening with removable cover, having its interior surface matching the volute contour, shall be located on the casing at the impeller centerline, to allow access to interior of the impeller.
- 15.3.4. Casing shall be split perpendicular to the shaft, with removable suction cover and stuffing box cover.
- 15.3.5. Machined fits for these parts shall be accurately aligned and identical so that casing may be installed for either clockwise or counter-clockwise direction of rotation. Casing shall be so arranged that the impeller may be removed without disturbing either suction or discharge piping.
- 15.3.6. Discharge flange shall be ANSI 125-pound flat face. All flange bolt holes shall be slotted for ease of assembly and disassembly. The discharge flange shall be drilled and tapped for gauge connection.

15.4 SUCTION COVER

- 15.4.1. Shall be removable to allow for access to the impeller.
- 15.4.2. It shall be made of cast iron ASTM A-48 Class 30.
- 15.4.3. A 1/4" IPS tap shall be provided next to the suction flange.
- 15.4.4. The suction flange shall be ANSI 125 pound flat face.
- 15.4.5. The mounting hole shall be slotted for ease of assembly and disassembly.
- 15.4.6. Replacement rotating assembly shall not include suction cover or suction cover wear plate.

15.5 SUCTION COVER WEAR PLATE

- 15.5.1. A replaceable 11.5%-14% chrome steel wear plate shall be furnished.
- 15.5.2. It shall provide 1/4" minimum wear and shall be installed with its wear surface parallel to the end of the impeller inlet.

15.6 IMPELLER

- 15.6.1. Shall be of the single-suction, enclosed type with two vanes, made of cast iron.
- 15.6.2. Impellers shall be specially designed with smooth water passages to prevent clogging by stringy or fibrous materials, and shall be capable of passing solids having at least a sphere size of 3".
- 15.6.3. Impeller shall be dynamically balanced.
- 15.6.4. Impeller shall have a tapered bore and shall be keyed and secured to the shaft by an 18-8 Stainless Steel nut locked in place.
- 15.6.5. It shall be readily removable without the use of special tools.
- 15.6.6. Impeller wear rings: A replacement 11.5-14% chrome steel shaped wear ring shall be provided. Ring shall be mounted on impeller to provide a renewable surface opposite the suction cover wear plate.
- 15.6.7. Impeller clearance adjustment: Pump shall have provisions for adjustment of axial clearance. This adjustment shall be made through the use of shims placed between the frame and outboard bearing housing.

15.7 SHAFT

- 15.7.1. Pump shaft shall be high-strength carbon steel, AISI #1045 or 4140, accurately machined, tapered at the impeller end and of sufficient size to transmit full driver output.
- 15.7.2. It shall be protected from the pumped liquid by a shaft sleeve.
- 15.7.3. A seal shall be provided, by a synthetic rubber O-ring between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump.

15.8 SHAFT SLEEVE

- 15.8.1. Renewable shaft sleeves used with packing shall be of a corrosion-resistant 400 series stainless steel with a 500 Brinell hardness.
- 15.8.2. The sleeve provided shall extend through the stuffing box and under the gland.

15.9 STUFFING BOX COVER AND STUFFING BOX

- 15.9.1. Stuffing box cover: Stuffing box cover shall be made of close-grained cast iron with integral stuffing

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- box and shall be designed to accept either packing or mechanical seal.
- 15.9.2. Stuffing Box: Stuffing box shall consist of five (5) rings of graphite yarn (non-asbestos type) packing, a teflon seal cage, and a split-type gland to permit easy removal and access to packing. Sealing liquid connection to stuffing box shall be tapped in a convenient location. Ample space shall be provided for repacking the stuffing box.

15.10 BEARING FRAME AND BEARINGS

- 15.10.1. Bearing Frame: Pump bearing frame shall be one-piece rigid cast iron construction. Frame shall be provided with a cast iron bearing housing at the outboard end, and a cast iron end over at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants. Bearing Frame shall be designed so that complete rotation element, including motor, can be removed from casing without disconnecting piping or coupling.
- 15.10.2. Bearings: Bearings shall be designed for 50,000 hours minimum life at 50% of B.E.P. Radial inboard bearings shall be roller type suitable for all loads encountered in the service conditions. Outboard bearing arrangement shall consist of one deep groove ball bearing to take the radial loads and one angular contact bearing to take axial loads.
- 15.10.3. Bearing lubrication: Bearings shall be grease lubricated with provisions for addition and relief of grease.

PART THREE - EXECUTION

15.11 DELIVERY

- 15.11.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen Houston TX, 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 15.11.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 15.11.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 15.11.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

15.12 TOOLS AND SPARE PARTS

- 15.12.1 (4) Operations and Maintenance manuals.

15.13 WARRANTY

- 15.13.1. The manufacturer shall furnish the following to the owner:
- 15.13.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

16.0 LINE ITEM NO. 16 PUMP, CENTRIFUGAL PUMP

Make: ITT Allis Chalmers

Model: Model No. 2000 Series Bare Pump 4X3X13 or City Approved Equal

16.1 SUMMARY OF REQUIREMENT:

- 16.1.1. Scope: The supplier shall furnish two (2) ITT A-C Pump end suction centrifugal pumps, model 100, 2000 Series, size 4x3x13, of frame mounted design rated for 250 GPM @ 185 Ft when running 1750 RPM.
- 16.1.2. Construction shall be: Cast iron - bronze fitted with bronze sleeve and mechanical shaft seal.
- 16.1.3. Details of pump construction shall be as follows:
- 16.1.4. Casing: Casings shall be vertical-split with centerline discharge; foot supported and shall be made of cast iron. Castings shall be provided with tapped and plugged holes for priming, vent and drain.
- 16.1.5. Casing Connections:
- 16.1.6. Flanged Nozzles: Casing connections shall be ANSI 816.1, 125 psi, standard flat face flanges.
- 16.1.7. Casing Wearing Rings: Easily replaceable casing wearing rings of suitable material for service shall be provided in front and rear of impeller.
- 16.1.8. Casing Joint Gasket: An O-ring shall be provided at the casing joint to prevent leakage.
- 16.1.9. Impeller: Impeller shall be the single suction enclosed type made of bronze. Impeller shall be statically and hydraulically balanced. Drilled holes shall be provided through the impeller hub to balance axial thrust loads and keep positive pressure on the stuffing box. Impeller shall be keyed and locked to the shaft with a hex head impeller nut and washer, and shall be easily removable without the use of special tools.
- 16.1.10. Shaft: Pump shaft shall be high strength S.A.E. 1045 carbon steel sized to provide a minimum amount of deflection. Shaft shall be protected in the stuffing box area by a replaceable shaft sleeve.
- 16.1.11. Shaft Sleeve: Shaft sleeve shall be the renewable type (bronze) and shall completely cover the shaft in the stuffing box area. Shaft sleeve shall be securely locked in place to prevent axial movement.
- 16.1.12. Stuffing Box:
- 16.1.13. Mechanical Seal: Pumps shall be provided with single inside unbalanced mechanical shaft seals for leakless operation. A suitable arrangement shall be provided to furnish a portion of the pumped liquid to lubricate and cool the seal faces. Seal shall be suitable for conditions stated.
- 16.1.14. It shall be suitable to replace with packing if desired.
- 16.1.15. Internal Seal: An internal seal system, consisting of tubing, which connects the volute to the stuffing box shall be provided.
- 16.1.16. Bearing Frame and Bearings:
- 16.1.17. Bearing Frame: Bearing frame shall be rigid, one-piece cast iron construction. Frame shall be provided with catch basin reservoir with tapped drain hole to collect and pipe away stuffing box leakage.
- 16.1.18. Bearings: Bearings shall be ball type on both ends of the frame. Outboard bearings shall be locked in place and be sized to provide long life under thrust loads encountered. Both bearings shall be enclosed by replaceable caps.
- 16.1.19. Bearing Lubrication: Ball bearings shall be grease lubricated with provisions for the addition and relief of grease.
- 16.1.20. Deflector: A replaceable shaft deflector of non-corrosive material shall be provided to prevent the entrance of contaminants into the pump bearings at the inboard end of the bearing frame.

17.0 LINE ITEM NO. 17 PUMP, ROTATING ASSEMBLY ONLY

Make: ITT Goulds

Model: Model No. PWOV 8X5X17S or City Approved Equal

17.1 SUMMARY OF REQUIREMENT:

17.1.1. The City of Houston intends to purchase 1 (ONE) Rotating Assembly (pump, less volute) for the WAS Systems at its Turkey Creek WWTP. This Rotating Assemblies must fit the existing ITT Goulds/A-C vertical centrifugal pumps currently installed at the location. Rotating assemblies shall match existing units dimensionally and allow for mounting inside existing casings. The currently installed pumps are: ITT Goulds, Model PWOV, size 8X5-17S, rated at 2250 GPM @225 ft. running 1770 RPM.

17.2 SPECIFIC REQUIREMENTS:

17.2.1. Pump Construction: Pumps shall be constructed of material that will be able to completely withstand all hazards associated with operating continuously or intermittently in typical wastewater environment, without malfunction, for long periods of time.

17.2.2. Casing: Existing. (Do not include) Provide new casing gasket.

17.2.3. Impeller: Impeller shall be of the single suction, open type, made of 316SS. Impeller shall be designed to be capable of passing small solids and stringy materials. Impeller shall be dynamically balanced. Impeller shall be screwed onto the shaft in opposite direction of rotation to prevent loosening during normal operation.

17.2.4. Impeller clearance adjustment: Pump shall have provisions for adjustment of axial clearance. This adjustment shall be made through an adjusting nut assembly which permits the complete rotating element to be moved in an axial plane. Both coupling end and pump end bearings shall be mounted within the adjusting assembly to assure bearing alignment.

17.2.5. Shaft: Pump shaft shall be high-strength carbon steel, AISI #1140 or 4140, accurately machined and of sufficient size to transmit full driver output. It shall be protected from the pumped liquid by a shaft sleeve.

17.2.6. Shaft Sleeve: Renewable shaft sleeve shall be XH800 Ni-Chrome-Boron coated/316SS. Sleeve shall be the hook-type design secured between the back hub of the impeller and a shaft shoulder, free to expand the frame end.

17.2.7. Stuffing Box: Each pump shall be provided with a packed stuffing box. Box and cover shall be made of cast iron. Stuffing box shall contain five (5) rings of packing and lantern ring. Gland shall be split type to permit easy access and removal.

17.2.8. Bearing Frame: Pump bearing frame shall be rigid cast iron construction. Frame shall be provided with a cast iron bearing housing at the outboard end, and a cast iron end over at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants.

17.2.9. Bearings: Bearings shall be designed for 40,000 hours minimum life at 50% of B.E.P. Radial inboard bearings shall be roller type suitable for all loads encountered in the service conditions. Outboard bearing arrangement shall consist of one deep groove ball bearing to take the radial loads and one angular contact bearing to take axial loads.

17.2.10. Bearing Lubrication: Bearings shall be grease lubricated with provisions for addition and relief of grease.

17.3 MANUFACTURER:

17.3.1. The supplier and/or manufacturer shall be a pump company which also specializes in repairs and installation of pumps.

17.4 DELIVERY INSTRUCTIONS:

17.4.1. Entire assembled unit shall be delivered at COH#s Cullen Service Center, 7400 Cullen Blvd, Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

17.4.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

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17.4.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

17.4.4. Final Delivery details should also be coordinated with Mr. Ray Belton, Maintenance Section Chief, Wastewater Operations Branch, 7440 Cullen Blvd. Houston, Texas 77051 Phone # 713-562-4093

17.4.5. INSTALLATION: Will be done by the C.O.H. Maintenance Group.

17.5 OPERATIONS & MAINTENANCE MANUALS, DRAWINGS, TRAINING, & FOLLOW-UP:

17.5.1. The Manufacturer or Vendor to supply four copies of O & M Manuals.

17.5.2. Vendor to give training of required PM of Equipment, if needed

17.5.3. Vendor/Manufacturer to be available for questions or follow-ups of equipment training for the first three months of purchase.

17.6 WARRANTIES:

17.6.1. The Manufacturer shall provide one (1) year warranty from the date of delivery and give the City the Option to purchase extended warranty if it chooses to.

18.0 **LINE ITEM NO. 18 PUMP AND MOTOR, NON-POTABLE**

Make: ITT Goulds

Model: Model No. 3410 Split Case Pump 4x6-13 or City Approved Equal

18.1 **SUMMARY OF REQUIREMENT:**

- 18.1.1. Requirements for providing NPW Pumps (ITT Goulds Model 3410 Split Case) for the Southwest WWTP.
- 18.1.2. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 18.1.3. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of the ITT Goulds Model 3410 Split Case NPW Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 18.1.4. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 18.1.5. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The pump system shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.
- 18.1.6. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 18.1.7. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

18.2 **DESIGN REQUIREMENTS**

SIZE	4X6-13
GPM	600 GPM @ 147 Ft
RPM	1785 RPM

PART TWO - PRODUCTS

18.3 **CASING**

- 18.3.1. The casing shall be horizontally split.
- 18.3.2. The upper and lower halves shall be held together with cap screws, plus studs on each side of each stuffing box to aid in disassembly/reassembly.
- 18.3.3. Flanged suction and discharge connections shall be located in the lower half of the casing.
- 18.3.4. The casing shall be supported by integral cast feet.

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- 18.3.5. Separate bearing housings shall be attached to machined fits in each end of the casing with cap screws.
- 18.3.6. The upper half casing shall be provided with a vent connection, a priming connection and two stuffing box seal ring connections.
- 18.3.7. The lower half shall be provided with two drain connections.
- 18.3.8. Suction and discharge gauge connections shall be provided on the pump flanges.
- 18.3.9. Pump flanges shall be 125# rated.

18.4 IMPELLER

- 18.4.1. Impeller shall be of the enclosed double suction type made of silicon bronze (ASTM B584-875).
- 18.4.2. The impeller shall be keyed to the shaft to.
- 18.4.3. Impeller shall be machined and fitted with bronze wear rings.
- 18.4.4. Impeller shall be dynamically balanced to ISO G6.3.

18.5 WEARING RINGS

- 18.5.1. Case wear rings shall be supplied to maintain proper running clearance with impeller hubs and to minimize leakage between suction and discharge chambers of casing.
- 18.5.2. Rings shall be held in position by anti-rotation pins.
- 18.5.3. Impeller rings shall be held in position by axial set screws.

18.6 SHAFT

- 18.6.1. Shaft shall be made of 420 stainless steel.
- 18.6.2. Shaft shall be heavy duty design to minimize deflection and vibration.
- 18.6.3. The shaft deflection shall be a maximum of 0.002 inches at the stuffing box faces under the worst opening for water flush.
- 18.6.4. Pump shall be provided with seal piping from casing top to the seal housing.

18.7 BEARING HOUSING

- 18.7.1. Bearing housing shall be cast and bored integrally with lower half casing to assure accurate alignment of rotating assembly without need for external adjustment.
- 18.7.2. Bearings double row ball bearing shall be provided on thrust end; single row deep groove ball bearing on coupling end.
- 18.7.3. Thrust bearing shall be held in position on shaft with tapered snap ring and locked in bearing housing.
- 18.7.4. Radial bearing shall be free to float axially in housing to take radial load only.
- 18.7.5. Housings shall be completely sealed by Inpro VBX labyrinth seals and deflectors to exclude moisture and dirt making units suitable for outdoor installation.
- 18.7.6. Shall be grease lubricated with reliefs to prevent over lubrication.

PART THREE - EXECUTION

18.8 DELIVERY

- 18.8.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, T 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 18.8.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 18.8.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 18.8.4. Final Delivery details should also be coordinated with Gurdip Hyare (Phone # 832-395-5459).

18.9 TOOLS AND SPARE PARTS

- 18.9.1 (4) Operations and Maintenance manuals.

18.10 WARRANTY

18.10.1 The manufacturer shall furnish the following to the owner:

18.10.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

19.0 **LINE ITEM NO. 19 PUMP AND MOTOR**

Make: Moyno

Model: Model No. 2E008G1 CDF3AAA or City Approved Equal

19.1 **SUMMARY OF REQUIREMENT:**

- 19.1.1. Requirement for Polymer Transfer Pumps, with motors, at Keegans Bayou WWTP.
- 19.1.2. GENERAL: The City of Houston intends to procure Polymer Transfer Pumps for its Keegans Bayou Wastewater Treatment Plant. The proposed new pumps are to replace the old Moyno Pump Model 2000 2E 008G1 CDF3AAA Polymer Transfer Pumps currently installed at this location. However, equivalent pumps from other vendors could be acceptable. Therefore, prospective vendors are encouraged to visit the site to make sure that the pumps they offer will fit the existing location, with NO modifications to the existing structures and systems.
- 19.1.3. The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as “irregular” or “non-responsive”, any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder’s responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as “non-responsive”. All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 19.1.4. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is equal to or superior the old Moyno Model 2000 2E008G1 CDF3AAA Polymer Transfer Pumps currently installed at Keegans Bayou WWTP, as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation for each deviation or substitution.
- 19.1.5. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 19.1.6. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year’s production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein.
- 19.1.7. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.
- 19.1.8. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder’s proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO – PRODUCT/DESIGN REQUIREMENTS

19.2 The pump specified here will be used to pump polymer from the Bulk Tanks to the batch Mixing System.

19.2.1. **Pump**

- 19.2.1.1. Design Flow: 10 gpm @ 100 psi
19.2.1.2. Pump Inlet : 4”
19.2.1.3. Pump Discharge : 4”

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- 19.2.1.4. Pumps shall be of the heavy duty, positive displacement, and progressing cavity type with a gear joint drive train.
- 19.2.1.5. Rotor shall be machined from alloy steel (or 316 stainless steel).

19.2.2 Motor

- 19.2.2.1. Power: 5 HP
- 19.2.2.2. Voltage: 460V
- 19.2.2.3. Phase / cycle: 3/60
- 19.2.2.4. Motor speed : 1800 rpm
- 19.2.2.5. Shall comply with NEMA standard MG-1.
- 19.2.2.6. Combined service factor (combined effect of voltage, frequency), shall be a minimum of 1.15.
- 19.2.2.7. Motor shall have NEMA PREMIUM electrical efficiency or equivalent.
- 19.2.2.8. Voltage tolerance shall be, typically no less than 10% and no more than 5% from its voltage rating.
- 19.2.2.9. Motor and pump shall be on the same shaft.
- 19.2.2.10. Motor shall be fully compatible and be able to function as intended when connected to the existing switchgear and infrastructure.

PART THREE - EXECUTION

19.3 MANUFACTURERS/VENDOR SERVICES

- 19.3.1. The manufacturer shall furnish the services of a competent factory representative to do the following:
- 19.3.2. Inspect the system prior to delivery, supervise the City of Houston start up and testing of the system, and certify the system has been properly furnished and is ready for operation.
- 19.3.3. Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.
- 19.3.4. Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

19.4 TOOLS AND SPARE PARTS

- 19.4.1. The manufacturer shall provide the following to the owner:
- 19.4.2. Tools and spare parts for at least one year.
- 19.4.3. At least two copies of the Operations and Maintenance Manual.

19.5 WARRANTY

- 19.5.1. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start up which ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**
- 19.5.2. The vendor and/or the manufacturer shall allow the City the option to purchase an extended warranty.

19.6 DELIVERY

- 19.6.1. Entire assembled unit shall be delivered at COH's Cullen Service Center, 7440 Cullen Blvd, Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 19.6.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 19.6.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 19.6.4. Final Delivery details should also be coordinated with Mr. Gurdip Hyare, Managing Engineer, Plant Operations, Wastewater Operations Branch, 2525 S/Sgt. Macario Garcia, Houston, Texas 77020 (69th St WWTP, Phone # 832-395-5459).

20.0 LINE ITEM NO. 20 PUMP AND MOTOR, DOUBLE DISC SLUDGE FEED PUMP

Make: Penn Valley

Model: Model No. 6DDX76 6" or City Approved Equal

20.1 SUMMARY OF REQUIREMENT:

20.1.1. The City of Houston intends to procure two (2) 6-inch Double Disc Pump, Model 6DDX76 Sludge Feed Pumps for its Chocolate Bayou Wastewater Treatment Plant (WWTP). The proposed pumps to be purchased are the one demo pump of the new design, which we have been using for approximately 6 months, free of cost, with no problems, whatsoever. The second pump will be a brand new pump of the same kind. In addition, the exact same pumps are being recommended in our CIP Project for Chocolate Bayou WWTP Improvement, scheduled for construction in FY 2018. If the above-recommended pumps are purchased now, these will be deleted from the CIP Project during the final design and construction phases.

20.2 PRODUCT SPECIFICATIONS

20.2.1. The 6-inch Sludge Feed Pumps will be reliable and efficient for wastewater sludge handling, and should maintain efficiency even with high solids. The pumps should reduce the risk of clogging, even under the worst conditions.

20.2.2. Pump:

- 20.2.2.1. 6-inch Double Disc Pump, Model 6DDX76
- 20.2.2.2. Pump Capacity (Maximum): 200 gpm @ 40 ft. TDH
- 20.2.2.3. Pump Capacity (Minimum): 50 gpm @ 40 ft. TDH
- 20.2.2.4. Maximum Discharge Head in feet: 140 TDH
- 20.2.2.5. Maximum Pump speed: 200 RPM
- 20.2.2.6. Pump suction and discharge size: 6"
- 20.2.2.7. Solid percentage handling: 1.5 – 4%
- 20.2.2.8. Spare Parts, including Disc Removal Tool

20.2.3. Motor:

- 20.2.3.1. Variable speed drive
- 20.2.3.2. Maximum Motor Speed: 1200 RPM
- 20.2.3.3. Motor Horse Power: 15 HP
- 20.2.3.4. Service factor: 1.15
- 20.2.3.5. Voltage: 230 – 460 Volts, 3 Phase, 60 Hertz
- 20.2.3.6. Power Factor: 82% @ 100 % full Load
- 20.2.3.7. Efficiency: 92.4 % @ 100% full speed
- 20.2.3.8. Encl.: TEFC, Premium Efficiency Severe Duty

20.2.4. More details on the Specifications are given in the attached document 11300.

20.3 EXECUTION

20.3.1. MANUFACTURERS/VENDOR SERVICES

- 20.3.1.1. The manufacturer shall furnish the services of a competent factory representative to do the following:
- 20.3.1.2. Inspect the system prior to delivery, supervise the City of Houston start up and testing of the system, and certify that the system has been properly furnished and is ready for operation.
- 20.3.1.3. Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.
- 20.3.1.4. Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

20.3.2. TOOLS, SPARE PARTS, AND O&M MANUALS

- 20.3.2.1. The manufacturer shall provide the following to the owner:
- 20.3.2.2. Spare parts and tools for at least one year, including the Disc Removal Tool.

20.3.2.3. At least three copies of the Operations and Maintenance Manuals.

20.3.3. WARRANTY

20.3.3.1. The equipment shall be warranted for a period of two (2) year against defects in workmanship and materials under normal use, operation and service. If the equipment should fail during the warranty period due to a defective part, it shall be replaced and the units restored at no expense to the owner. Should the Manufacturer's warranty exceed these requirements; the Manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable period, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

20.3.3.2 The vendor and/or the manufacturer shall allow the City the option to purchase an extended warranty.

20.3.4. DELIVERY

20.3.4.1. Entire assembled unit shall be delivered at Cullen Service Center, 7440 Cullen Blvd, Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the unit.

20.3.4.2. The unit shall be packaged to prevent any damage during travel and off-loading.

20.3.4.3. Final Delivery details should be coordinated with Mr. Sidney Bomer, Operations Manager, Wastewater Operations Branch, (Phone # 713-557-9767).

20.3.4.4. The delivery company must also coordinate with the appropriate City of Houston Receiving Staff at Cullen Service Center, to ensure that the unit is off-loaded safely in the appropriate place and in the manner desired by the City of Houston.

21.0 **LINE ITEM NO. 21 PUMP, SELF PRIMING PUMP W/BASE PLATE, COUPLING & GUARD**

Make: Gorman Rupp

Model: Model No. T6A3-B/F 6X6 or City Approved Equal

21.1 **SUMMARY OF REQUIREMENT:**

21.1.1. Requirements for providing a Self-Priming Thickener Pump at Sims South WWTP

21.1.2. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The City may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

21.1.3. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved substitute T6A3-B/F Gorman Rupp Pump 200-400 GPM @47 ft. TDH pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation at each deviation or substitution.

21.1.4. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

21.1.5. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

21.1.6. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

21.1.7. 1Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must do so, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*

21.2 **DESIGN REQUIREMENTS**

21.2.1. The self-priming pump is to be used to pump waste activated and thickened sludge. These specifications are for pump, rotating assembly, baseplate, coupling and guard.

Operating Flow (Required)	200-400 GPM @47 feet TDH
Maximum NPSH _R	4.2 Feet
Suction Size	6 inch
Discharge size	6 inch
Horsepower and Speed	15 HP, 1750 RPM
Voltage	230V/460 V pre-wired 460V
PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION.	

21.3 EQUIPMENT AND PERFORMANCE

- 21.3.1. CASING and COVERPLATE: Pump castings and coverplate shall be cast iron class 30 or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Volute shall be designed to be smooth and free of blowholes and imperfections. Volute shall be designed to ensure passage of waste solids.
- 21.3.2. IMPELLERS: The pump impeller shall be of cast iron. Impeller shall be semi-open type, non-clog and designed with smooth passage to pass waste solids at heavy consistency such as waste activated sludge and thickened sludge. Impeller shall also be able to withstand solids, fibrous material, wastewater sludge and other material present in wastewater. Rotation of the impeller shall be secured via a lockscrew and conical washer.
- 21.3.3. BEARINGS AND SHAFT: Bearings shall be if cast iron class 30 or better. Bearing cavity shall have an oil level sight gauge and fill plug check valve. The sight class shall provide east monitoring of the bearing cavity oil level and condition of oil without removal if the fill plug check valve. The bearing shall be rated in accordance with Anti-Friction Bearing Manufacturers Association for a minimum L₁₀ bearing life of 100,000 hours at the best efficiency point. Bearings shall be suitable for all radial loads and axial load .Shaft shall be AISI 4140 alloy steel. Shaft shall be closed coupled directly to the pump shaft is using a solid sleeve coupling.
- 21.3.4. MOTOR: The frequency of the motor shall be 60 hertz and winding shall be insulation class F or better. Motor must be designed specifically for pump usage (water tight). Motor shall be non-overloading for the entire range of the operating curve within the name plate and shall be capable of no less than 10 evenly spaced starts per hour. Motor shall be rated for continuous on in air operation. A performance chart shall be provided showing curves.
- 21.3.5. SEAL: Each pump shall be provided with a tandem mechanical shaft seal system. The seal shall contain silicon-carbide faces .The upper seal set shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal shall be exposed to the lubricant in the bearing housing with no exposure to the pumpage. Seals shall rest on a 316 stainless steel shaft sleeve with seal tension held by 3 set screws.
- 21.3.6. PROTECTION: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped in the end of the coils of the stator winding .These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. The pump shall be equipped with moisture sensors in the oil filled seal chamber to indicate seal leakage. Surface material is to be sandblasted and finished coated with epoxy.
- 21.3.7. RE-PRIME: During operation, pump shall retain adequate liquid in the casing to ensure automatic re-priming while operating at its rated speed in a completely open system. The need for a suction or external priming device shall not be required. The pump must re-prime and deliver fill capacity within five minutes after five minutes after pump is energized.

PART THREE - EXECUTION

21.4 DELIVERY

- 21.4.1. Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 21.4.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 21.4.3. The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 21.4.4. Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

21.5 TOOLS AND SPARE PARTS

21.5.1 (4) O&M (Operations and Maintenance manuals).

21.6 WARRANTY

21.6.1. The manufacturer shall provide the following to the owner:

21.6.2. One (1) year warranty from the date of final system acceptance.

21.6.3. Components failing to perform as specified by the engineer or City of Houston representative shall be replaced, repaired, or satisfactorily modified by the supplier without cost of parts or labor to the owner.

21.7 MANUFACTURERS/VENDOR SERVICES

21.7.1. The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

21.7.2. Provide complete training and local service capability for a period of not less than one half day.

21.7.3. Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

21.7.4. Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

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22.0 **LINE ITEM NO. 22 PUMP, SCUM**
Make: Haywood Gordon Scum Pump
Model: Model No. X84-12 or City Approved Equal

22.1 **SUMMARY OF REQUIREMENT:**

Pumps shall be of the horizontal centrifugal type with a fully recessed impeller design. The impeller must be mounted completely out of the flow path between pump inlet and outlet connections. Pumps shall be of a heavy duty construction, capable of handling large solids and abrasive particles. Pumps must meet following operating conditions: 650 GPM, 40 TDH, 1750 RPM

22.2 **Casing:**

22.2.1. Where radial vane impellers are used, the pump casing shall consist of a one piece casting with integral suction and discharge nozzles plus a back plate with integral wear element. The casing will have cast on feet, which will fully support the volute, to allow removal of the complete rotating assembly, without disturbing suction and discharge piping.

22.2.2. For cup type impellers the casing shall consist of a removable suction piece large enough for the impeller to be withdrawn without the need to disturb the discharge piping; a center volute casing with integral discharge flange plus a separate rear wear liner.

22.2.3. Casing thickness shall be a minimum 0.75 inch (with normal casting tolerance.)

22.3 **Impeller:**

22.3.1. Impellers shall be fully recessed out of the casing passage and must be either a heavy duty radial vane or cup-type vane design. Impellers shall be fitted with full back pump out vanes to restrict flow behind the impeller and shall be keyed to the shaft and secured by a shrouded securing bolt and lock washer.

22.3.2. The minimum thickness at the front edge of the impeller vane shall be 0.5 inches

22.4 **Wear Element:**

22.4.1. Pumps with radial vane impellers shall be fitted with a rear casing wear plate and integral radial wear element, which will protect the area behind and at the periphery of the impeller from the brunt of abrasive wear. The radial wear element will be of a tapered design to promote flow of solids out of the impeller recess.

22.4.2. Minimum thickness at the base of the radial wear element shall be 1.25" Minimum thickness at the tip of the radial wear element shall be 0.875"

22.4.3. Wear elements should be self-centering, with jacking screws provided to facilitate removal.

22.4.4. Pumps with cup type impellers shall have a separate removable suction piece to absorb wear in the suction area, where this impeller directs abrasive material. The suction wear piece shall have a minimum thickness of 0.875" for a 3", 1.25" for 4" and 6" and 1.3" for 8" pumps.

22.5 **Materials of Construction:**

22.5.1. The volute, impeller and wear elements shall be constructed from Super Ni-Hard ASTM A532 with a minimum hardness of 650 BHN for all applications containing grit-silica sand with a hardness of 570-

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22.5.2. 590 BHN will quickly erode softer materials. Hardness measurement certificates to be provided confirming a minimum of 650 BHN for impeller, casing and wear plate and/or suction piece (if applicable).

22.6 Shaft:

22.6.1. The shaft shall be constructed of 4140 steel protected through the seal area by a renewable 410 Stainless steel hardened hook type shaft sleeve (OR: 316SS sleeve where mechanical seals are specified). An O-ring between the sleeve and shaft will prevent pump fluid contacting the pump shaft.

22.7 Stuffing Box:

22.7.1. The stuffing box shall be constructed of Cast Iron A-48 Class 30, designed to accommodate a single mechanical seal with silicon carbide seal faces..

22.7.2. Any leakage will be retained by a drainable reservoir integral with the bearing housing. A 0.75" NPT hole will be provided to connect seal water drainage piping.

22.8 Bearing Frame:

22.8.1. The bearing frame will be manufactured from Cast Iron and shall be fitted with a constant level sight glass oiler and vent and drain plugs for oil lubrication or grease nipples for grease lubrication.

22.8.2. Bearing lives are to be rated for a minimum of 100,000 Hrs L₁₀ life, based on calculated loads due to hydraulic thrust at the duty point, as well as other mechanical loading due to belt drives or shaft and impeller weight.

22.9 Pump and Motor Base:

22.9.1. The pump and motor base shall be fabricated from steel, designed to provide rigid support of the pump and motor. Each base shall be furnished with suitable bolt and grout holes to facilitate mounting at site. Units shall be provided with either V-Belts and sheaves or a direct drive coupling to provide the required pump speed to meet performance conditions. Suitable OSHA guards are required.

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23.0 LINE ITEM NO. 23 PUMP , HEAVY DUTY SOLIDS HANDLINGT

Make: Chicago Yeoman Series 2111

Model: No.VPM-OLC-10 or City Approved Equal

23.1 SUMMARY OF REQUIREMENT:

23.1.1. Furnish and install four (4) Vertical Pedestal Mounted Pumping Units complete with all accessories and appurtenances as shown in the plans and specified herein or as required for a complete operating system. Each Pumping Unit shall be rated for continuous duty in accordance with the operating conditions defined in Table 1 of these specifications. Each unit shall be furnished with pump, pump support pedestal, suction elbow, motor pedestal, flexible coupling & guard. **Each Pumping Unit shall be rated for continuous duty in accordance with the following operating conditions: 3,125 GPM, 30' Head, 870 RPM. The pump discharge is 10" in diameter.**

23.2 QUALITY ASSURANCE

23.2.1. Pumps are to be engineered and manufactured under a written Quality Assurance program certified to the ISO 9001:2000 Quality System Standard. The Quality Assurance program is to have been in effect for at least five (5) years and shall include a written record of periodic internal and external audits to confirm compliance with ISO 9001:2000 requirements.

23.3 QUALITY CONTROL

23.3.1. The pumps shall conform to all applicable requirements of ASTM, ANSI and Hydraulic Institute. For purposes of this specification, the revision and/or version of the referenced standards in effect on the date of public bid opening shall apply.

23.3.2. The specified pumps shall be the products of reputable manufacturers who have been regularly engaged in the design, manufacture and furnishing of wastewater pumping equipment for at least ten (10) years. The manufacturer of the pump shall assume full responsibility for compatibility of the supplied components with the application.

23.4 PUMP CONSTRUCTION

23.4.1. Pumps shall be solids-handling type and each shall be complete with accessories as follows:

23.4.2. The pump casing, bearing housing, pump pedestal, floor plate, packing housing, suction cover and casing cover shall be manufactured of close-grained ASTM A-48, Class 30 cast iron. A suction elbow shall be provided with a hand-hole. A second hand-hole shall be provided in the pump casing.

23.4.3. The impeller shall be manufactured of close-grained ASTM A-48, Class 30 cast iron and dynamically balanced. The impeller shall be of the two-part closed design capable of passing a three inch sphere.

23.4.4. The pump shaft shall be machined from high grade alloy steel.

23.4.5. A large packing box shall be bolted to the pump casing. The packing box shall be provided with not less than five rings of graphite impregnated braided acrylic packing, a water seal ring and tapped connections so that seal water from an outside source or grease lubrication sealing may be provided. The pump shaft shall be protected from wear at the packing box by a slip-on type stainless steel sleeve.

23.4.6. The pump shall have two sets of deep-grooved single-row ball bearings designed for both radial and thrust loads. The bearings shall be mounted in a dust and moisture proof housing that is bolted to the pump casing to insure permanent alignment. Alemite fittings shall be furnished at each ball bearing for grease lubrication.

23.4.7. Pumps and supports shall receive one coat of an environmentally safe machinery enamel coating with a high solids content.

23.4.8. A motor support pedestal shall be bolted to the pump casings. The electric motor shall be directly connected by flexible coupling to the pump shaft

23.5 TESTING

23.5.1. The natural frequency of the assembled pump and its supporting structure shall be at least 25 percent higher than the maximum pump excitation frequency. The pump shall operate within the vibration limits of the Hydraulic Institute

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- 23.5.2. The pumps shall be performance tested at the manufacturer's plant before shipment in accordance with Hydraulic Institute standards. Upon request, certified copies of the test curves shall be submitted to the engineer.
- 23.5.3. Each pump shall be hydrostatically tested at the manufacturer's plant before shipment in accordance with Hydraulic Institute standards. Upon request, certified copies of the test results shall be submitted to the engineer.

23.6 FIELD SERVICE

- 23.6.1. Days of Field Service shall be provided by an authorized, factory trained representative of the Pump Manufacturer. Services shall include, but not necessarily be limited to, inspection of the completed installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Manufacturer's Prescribed Warranty.
- 23.6.2. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

24.0 LINE ITEM NO. 24 PUMP, HEAVY DUTY VERTICAL MOTOR

Make: Chicago Yeoman

Model: No. Series 2111, OSC-10, 30 HP or City Approved Equal

24.1 SUMMARY OF REQUIREMENT:

24.1.1. This specification provides guidelines for design and manufacture of low and medium voltage vertical squirrel cage induction motors

24.1.2. Work governed by these specifications includes manufacture, testing, and delivery of equipment constructed in accordance with the requirements presented herein.

24.1.3. Items not addressed by these specifications include, but are not limited to:

24.1.3.1. Unloading and Installation

24.1.3.2. All External Connections

24.2. Codes and Standards

24.2.1. All equipment shall be fabricated, assembled and tested in accordance with the most current applicable standards as defined by the following institutions:

24.2.1.1. American National Standards Institute (ANSI)

24.2.1.2. Institute of Electrical and Electronic Engineers (IEEE)

24.2.1.3. National Electrical Manufacturer's Association (NEMA)

24.2.1.4. Anti-Friction Bearing Manufacturer's Association (AFMBA)

24.2.2. All materials and equipment shall be labeled or listed as being approved by the Underwriter's Laboratories (U.L.) whenever applicable.

24.2.2.1. Equipment offered as meeting the intent of the U.L. requirements may be acceptable subject to the approval of the purchaser.

24.3. Conditions of Service

24.3.1. Motors shall be suitable for continuous operation on a three-phase, 60 hertz system rated 460 volts. Motor Shall be 30-Horsepower and 875 RPM.

24.3.2. Motors shall be designed to operate at rated load in a maximum ambient temperature of 40°C at a maximum altitude of 1,000 meters.

24.3.3. The location of installation will be either indoors or outdoors as dictated by the specific provisions for each motor.

24.3.4. Motor Shall Be Furnished by the Yeoman's Chicago Corporation to Fit Existing Chicago Pump Series 2111, Model OSC-10, 30-Horsepower Pumps.

Design Requirements

24.4 General

24.4.1. Motors shall be capable of withstanding all normal forces which may be imposed upon them during the course of normal operation, including starting and normal stops.

24.4.2. Motors shall be suitable for across the line starting and shall be able to start and accelerate the connected load to full load speed with 90 percent of rated voltage at the motor terminals.

24.4.3. Motors shall be capable of continuous operation at full load and rated frequency with a voltage variation of ± 10 percent.

24.4.4. Motors shall be capable of continuous operation at full load and rated voltage with a frequency variation of ± 5 percent.

24.4.5. Motor starting current shall not exceed a value equal to 650 percent of the motor full load current.

24.4.6. Motor installations in hostile environments subject to dust, moisture and/or corrosive atmospheric conditions shall have all parts given protective treatment.

24.5 Enclosure

24.5.1. Motors shall be furnished with one of the following enclosure types based on the location of installation and the specific requirements for each motor.

24.5.1.1. Weather Protected, Type I (WP-I)

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- 24.5.1.2. Weather Protected, Type II (WP-II)
- 24.5.1.3. Totally Enclosed, Fan Cooled (TEFC)
- 24.5.1.4. Totally Enclosed, Explosion proof (XP) for applicable Class, Group, Division, and Temperature Code.

24.5.2. Openings on all Weather Protected designs shall be covered with metal guard screens having a mesh size no greater than ½ inch square.

- 24.5.2.1. When specified, Weather Protected, Type II designs shall be furnished with removable, cleanable and reusable air filters over intake air openings.

24.5.3. Enclosures shall be of fabricated steel or cast iron construction in accordance with manufacturer's standard design. Canopy caps shall be of aluminum, cast iron or sheet metal and shall be easily removable for maintenance purposes.

24.5.4. Motors to be installed in locations where moisture may collect shall be furnished with drain openings and plugs. In the case of Explosion proof Motors, drains shall be furnished and shall be of the type approved by U.L.

24.6 Stator Construction

24.6.1. Stator laminations shall be of fully processed steel. Each lamination surface shall be given the necessary treatment to have core plate type C-5 insulation.

24.6.2. Stator windings for system voltages above 600 volts shall be form wound of rectangular copper magnet wire. Aluminum magnet wire is not acceptable. Individual coils shall be insulated with mica bearing tape prior to insertion. Coil extensions shall be blocked and braced sufficiently to minimize movement during normal starting and running conditions at full rated voltage.

24.6.3. Insulation

- 24.6.3.1. Insulation system shall be Class B or better

- 24.6.3.2. Insulation system shall receive a minimum of two vacuum pressure impregnation treatments using a 100 percent solids epoxy resin for form wound coils. Others shall receive similar treatments of 100 percent solids polyester resin.

- 24.6.3.3. When specified, a completely sealed insulation system shall be supplied. This system shall be capable of passing the NEMA MG 1-20.48 water immersion test.

24.6.4. Temperature rise shall not exceed the limits defined by NEMA for Class B insulation systems while operating at nameplate horsepower, frequency and voltage.

- 24.6.4.1. In the case of a particular rating where a Class F temperature rise is required, motors shall be furnished with Class F or better insulation.

24.7 Rotor Construction

24.7.1. Rotors shall be of cast or fabricated aluminum in accordance with manufacturer's standard design.

24.8 Bearings

24.8.1. Bearings supplied shall be of type and size sufficient to satisfy thrust loading requirements for each motor in accordance with manufacturer's standard design. Bearings shall be rated for an in-service B-10 life of 8,800 hours.

24.8.2. Thrust Bearings

- 24.8.2.1. Motors shall be designed and constructed with thrust bearings on top to allow inspection and/or replacement without requiring complete disassembly of motor.

24.8.3. Guide bearings or bearing assemblies shall be provided with sufficient means for preventing the leakage of lubricant or entrance of foreign matter along the shaft.

24.8.4. Lubrication

- 24.8.4.1. Thrust bearings shall be oil lubricated and contained in an oil reservoir with oil sight level gauge and oil fill and drain openings with plugs.

- 24.8.4.2. Deep-groove ball bearings furnished as thrust bearings for normal thrust motors shall be grease lubricated. When furnished as guide bearings for high thrust units, they shall be oil lubricated.

- 24.8.4.3. Grease lubricated bearings shall be furnished with provisions for in-service positive lubrication. A drain shall be provided to guard against over lubrication.

24.9 Noise Level

24.9.1. Sound pressure levels shall be measured according to IEEE 85 and shall not exceed 90 decibels as measured on the A-Weighted Scale at a distance of five (5) feet from any motor surface under no load free field conditions. Special noise levels may be required when specified.

24.10 Nameplates

24.10.1. Motor nameplates shall be of stainless steel and shall be securely fastened to the motor frame with pins of a like material.

24.10.2. The following information shall be contained on the motor nameplate as a minimum:

- 24.10.2.1. Rated Horsepower
- 24.10.2.2. Full Load Speed
- 24.10.2.3. Frequency
- 24.10.2.4. NEMA KVA Code and Design Letter (when applicable)
- 24.10.2.5. Rated Voltage
- 24.10.2.6. Manufacturer's Serial Number
- 24.10.2.7. Service Factor
- 24.10.2.8. Insulation Class
- 24.10.2.9. Maximum Ambient
- 24.10.2.10. Full Load Current at Nameplate Voltage
- 24.10.2.11. Frame Size Designation

24.11 Terminal Boxes

24.11.1. Terminal boxes shall be of fabricated steel or cast iron construction to be compatible with the motor enclosure specified and when possible, shall be diagonally split and capable of rotation in 90° increments. Boxes not suitable for rotations must be capable of top entry.

24.11.2. The area in which the main terminal box is connected with the motor frame shall be fully gasketed in order to prevent entrance of foreign matter into the motor and to provide support for the stator leads where they pass through the motor frame.

24.11.3. A properly sized grounding terminal shall be mounted in the main terminal box when specified.

24.11.4. The main terminal box shall be sufficiently oversized to allow stress cone terminations of shielded power cables and to allow the mounting of any surge capacitors, lightning arrestors, or current transformers when specified.

24.12 Leads

24.12.1. Main motor leads shall have EPDM or equal type jackets and shall be permanently tagged for identification.

24.12.2. The relationship between lead markings and the direction of rotation shall be indicated on a separate motor nameplate.

Accessories

24.13 Space Heaters

24.13.1. When specified, motors shall be furnished with space heaters to provide sufficient wattage to maintain the internal temperature of the motor at a level approximately 10°C above the ambient temperature while the motor is not in operation.

24.13.2. Space heaters shall be of the silicone rubber strip type attached to the stator end turns. When specified, leads shall be brought out to an auxiliary terminal box.

24.13.3. Space heaters shall be rated for operation on a single phase, 60 hertz, 120 volt system.

24.14 Protective Devices

24.14.1. When specified, stator winding protection shall be provided consisting of one or more of the following systems:

- 24.14.1.1. One (1) positive temperature co-efficient (PTC) thermistor temperature sensor embedded in each phase of the stator winding and corresponding solid state electronic control.

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- 24.14.1.2. Three (3) bi-metallic thermostats of the automatic reset type, with normally closed contacts, mounted one per phase. Each thermostat shall be furnished with leads suitable for connection to the control circuit.
- 24.14.2. When specified, surge protection shall be provided in the form of surge capacitors and lightning arrestors mounted, one (1) per phase in the main terminal box.

Testing

- 24.15 When specified, one (1) motor shall be given a complete initial test in accordance with IEEE 112 Method B and shall include the following items:
 - 24.15.1. Current Balance
 - 24.15.2. High Potential Test
 - 24.15.3. Vibration Test
 - 24.15.4. Winding Resistance
 - 24.15.5. Locked Rotor Current
 - 24.15.6. No Load Running Current
 - 24.15.7. Full Load Heat Run
 - 24.15.8. Full Load Percent Slip
 - 24.15.9. Efficiency at 100, 75 and 50 percent Load
 - 24.15.10. Power Factor at 100, 75 and 50 percent Load
 - 24.15.11. When specified, noise test shall be performed in accordance with IEEE standard 85.
 - 24.15.12. When specified, water immersion test shall be performed in accordance with NEMA MG 1-20.48.
 - 24.15.13. Five (5) copies of certified test reports shall be submitted to the purchaser upon completion of all required tests.
 - 24.15.14. The purchaser reserves the right to witness any or all of the tests specified to be performed. Prices for this shall be included as a separate item in the seller's quotation.

Submittal Data

- 24.16 Required with Proposal
 - 24.16.1. Preliminary Dimension Print and Frame Size
 - 24.16.2. Approximate Motor Weight
 - 24.16.3. Complete Motor Nameplate Information
 - 24.16.4. Motor Performance Data, including the following:
 - 24.16.4.1. Guaranteed minimum efficiency at 100, 75 and 50 percent of full load
 - 24.16.4.2. Guaranteed minimum power factor at 100, 75 and 50 percent of full load.
 - 24.16.4.3. Locked Rotor Current
 - 24.16.4.4. Full Load Current
 - 24.16.4.5. Starting Torque
 - 24.16.4.6. Full Load Torque
 - 24.16.4.7. Breakdown Torque
 - 24.16.5. Complete Description of Testing Facilities
 - 24.16.6. Jobsite Storage Requirements
 - 24.16.7. Required within Six (6) Weeks of Purchase Order Award
 - 24.16.8. Certified Dimension Prints
 - 24.16.9. Recommended Spare Parts List, Priced
 - 24.16.10. Required with Motor upon Shipment
 - 24.16.11. Operation and Maintenance Manual
 - 24.16.12. Connection Diagrams
 - 24.16.13. Test Reports as Specified

Acceptable Manufacturers

- 24.17 Motors shall be provided by the Yeoman's Chicago Corporation and be Capable of Direct Mounting to the Series 2111, Model OSC-10 Vertical Pump.

25.0 LINE ITEM NO. 25 PUMP, HEAVY DUTY WASTING PUMP

Make: Chicago Yeoman

Model: No. LMC4 VPM or City Approved Equal

25.1 SUMMARY OF REQUIREMENT:

- 25.1.1. The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as “irregular” or “non-responsive”, any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder’s responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as “non-responsive”. All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 25.1.2. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement for the Yeomans Wasting Pumps model LMC4 as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 25.1.3. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 25.1.4. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year’s production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The supplier shall be required to provide the wasting pumps and all parts required for the Yeomans Wasting Pumps model LMC4. The supplier shall include and match the current mount which is a horizontal base mount. The wasting pumps shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.
- 25.1.5. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 25.1.6. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder’s proposal and will be provided without cost or obligation to the *City of Houston*.

25.2 DESIGN REQUIREMENTS

RATED DUTY	300 GPM @ 39.4’ TDH @ 1750 RPM
IMPELLER DIAMETER	7.125”
ELECTRIC DRIVE MOTOR	7.5 HP
DISCHARGE PRESSURE	15.5 PSI
MOTOR SPEED	1750 RPM

PART TWO - PRODUCTS

25.3 PUMP

- 25.3.1. The output shall be 400 GPM @ 35.0’ TDH @ 875 RPM
- 25.3.2. Impeller diameter shall be 12.625”
- 25.3.3. The inlet and outlet size shall be 4-inch suction and discharge
- 25.3.4. Pump shall have dual mechanical seal

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25.3.5. Pump shall have hardened 420 stainless steel wear rings

25.4 MOTOR

25.4.1. Motor speed shall be 875 RPM

25.4.2. Motor shall be 7.5 HP

25.4.3. Motor shall be electric with a 1.15 service factor

25.4.4. Motor shall have a totally enclosed fan cooled

PART THREE - EXECUTION

25.5 DELIVERY

25.5.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

25.5.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

25.5.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

25.5.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

25.6 TOOLS AND SPARE PARTS

25.6.1 (4) Operations and Maintenance manuals.

25.7 WARRANTY

25.7.1. The manufacturer shall furnish the following to the owner:

25.7.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

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26.0 **LINE ITEM NO. 26 PUMP, HEAVY DUTY BOOSTER PUMP**

Make: PACO

Model: No. KP 2930958030001 or City Approved Equal

26.1 SUMMARY OF REQUIREMENT:

Furnish, as described in these specifications, a Paco model KP double suction horizontal split case centrifugal pump (s), or equal, designed to deliver the scheduled flow rate (in GPM), the specified total dynamic head (in feet), at the scheduled efficiency and scheduled speed (RPM). OPTION: (The pumps shall also be NSF-50 and NSF-61 certified.) **378 GPM, 90.5 TDH, 3545 RPM.**

26.2 To insure cavitation-free operation, each pump's NPSH requirement must be low enough to permit stable, continuous operation at 120% or greater of best efficiency point.

26.3 Casing:

Pumps shall have the casing divided on the horizontal centerline. The casing halves shall be accurately machined, bolted and doweled together. A non-asbestos type gasket material shall be furnished between the casing halves. The casing material shall be close-grained cast iron with a minimum tensile strength of 35,000 P.S.I. Removal of the upper casing half and bearing housings shall permit removal of the complete rotating assembly without disturbing piping connections. Pumps shall be provided with removable bearing housings which will permit inspection and/or replacement of the mechanical seals, shaft sleeves, and bearings without removing the rotating assembly or top casing half. Pumps with 4 inch or larger discharge flanges shall be of the double volute design.

26.3.1 Casings shall be designed for scheduled working pressure and shall be hydrostatically tested at 150% of the maximum working pressure under which the pump could operate at design speed. Suction and discharge flanges shall be drilled to ANSI Standards and be machined flat face. Pumps shall be fitted with (lead-free bronze) (cast iron) renewable case wear rings indexed with a dowel pin for fixed positioning.

26.4 OPTIONS: case material-of-construction- Ductile Iron (A536), Bronze (B145), 316SS

26.5 Impeller:

The lead-free bronze impeller shall be an enclosed Francis vane type, double suction design, hydraulically and dynamically balanced. The impeller is to be securely mounted on the pump shaft, and attached with a steel key. The impeller shall be locked in position by threaded shaft sleeves. The impeller shall be trimmed to meet the specific hydraulic requirements. Impeller trim must be equal to or less than 90% of maximum diameter which will fit into the pump casing.

26.6 Shaft:

The pump shaft shall be made of high tensile steel, precision ground to provide a true running rotating element.

26.7 Bearings:

The pump shaft shall be adequately supported by the pump bearings to limit the shaft deflection to 0.002 inches.

26.7.1 Bearings shall be ball type, grease lubricated and locked to the shaft with positive locks of ample size to withstand any axial thrust loads. Each bearing housing shall be bolted to the upper and lower casing halves for a full 360-degree support registered fit to insure positive alignment. Bearing shall provide a minimum life of 10 years when calculated at 50% of Best-Efficiency-Point for the scheduled pump.

26.8 Shaft Seals:

The pump manufacturer shall recommend the proper mechanical seal based on the pressure, temperature and liquid outlined on the equipment schedule. Mechanical seals, at a minimum, shall have ceramic stationary seats, carbon rotating seats, and Buna elastomers.

26.9 Shaft Sleeves:

Lead-free bronze shaft sleeves shall be firmly attached to the pump shaft through threading and locking means. Shaft sleeve design shall prevent corrosion and wear to the shaft.

26.10 Base, Coupling, and Guard:

The pumps shall be mounted on a (cast iron base with drain) or (steel base with drip pan) and directly connected through a heavy-duty flexible coupling to a horizontal motor as outlined in these specifications. The pump manufacturer shall provide an OSHA coupling guard, which shall be mounted between the pump and motor and attached firmly to the base.

26.11 Motors:

The motor shall be sized to operate continuously without exceeding the horsepower rating (as outlined on the schedule) regardless of the flow and head throughout the operating range of the "System Curve." Motors shall meet EPAC standards for efficiency as a minimum.

27.0 **LINE ITEM NO. 27 PUMP, ROTATING ASSEMBLY WITH PACKING**

Make: Fairbanks Morse

Model: No. 5414S 8" or City Approved Equal

27.1 **SUMMARY OF REQUIREMENT:**

This specification includes the supply of 1 vertical dry-pit solids-handling pump rotating assembly.

27.2 **QUALITY ASSURANCE**

27.2.1 All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

27.2.2 Unit responsibility. Pump(s), complete with motor, intermediate shafting, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

27.2.3 The vertical dry-pit solids-handling pump(s) specified in this section shall be furnished by and be the product of one manufacturer.

27.2.4 Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

27.2.5 Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.

27.3 **PERFORMANCE**

27.3.1 The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.

27.3.2 **OPERATION CRITERIA**

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage
Design Condition	2500	40ft	1185	3"

27.3.3 Liquid pumped is raw wastewater

27.4 **PUMPS**

27.4.1 **Manufacturers**

27.4.1.1 Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.

27.4.2 **Design**

1. **Rotation**

a. The pump will be (clockwise)(counterclockwise) rotation when viewed from the driver end looking at the pump.

2. **Impeller**

a. The impeller shall be of the balanced non-clogging type made of close-grained cast iron conforming to ASTM A48 CL30. It shall be of one-piece construction, single suction, enclosed (bladeless)(two-vane)(three-vane), radial flow design with well-rounded leading vanes and then tapered toward the trailing edge for a circular flow pattern. The waterways through the impeller will have extremely smooth contours, devoid of sharp corners, so as to prevent rags or stringy, fibrous material from catching or clogging.

- b. The clearance between the impeller outside diameter and cutwater shall be capable of passing a 3” sphere.
 - c. The impeller is to be balanced and secured to the shaft by means of a bolt, washer, and key. The arrangement shall be such that the impeller cannot be loosened from torque in either forward or reverse rotation.
 - d. Wiper vanes on the back impeller shroud are not allowed.
3. **Volute/Casing**
- a. The volute shall be matched to the impeller and made of close-grained cast iron conforming to ASTM A48 CL30. The volute is to be of one-piece circular constant flow, equalizing pressure design with smooth fluid passages large enough to pass any size solid that can pass through the impeller.
 - b. The volute shall be side flanged tangential discharge and capable of rotation in 45 degree increments to accommodate piping orientation. Diffusion vanes are not permitted.
 - c. The volute shall be furnished with large cleanout openings located at the impeller centerline, to allow access to the impeller. Volute priming, drain and 1/2” minimum gauge connections shall be provided. Flanges shall be 125 lbs. (250 lb. discharge flange on 6”C5416) flat faced flanges per ANSI drilling.
 - d. The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction or discharge piping. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.
4. **Wear Rings**
- a. Wear rings shall be provided on both the impeller and fronthead so that clearances can be maintained throughout the life of the rings and minimize recirculation.
 - b. Impeller wear rings shall be of the L-shaped axial- or face-type.
 - c. Fronthead wear rings shall be of the axial- or face-type.
 - d. Wear rings shall be attached to the impeller and fronthead using an interference fit and Loctite.
 - e. Wear rings shall be stainless steel, with the impeller wear ring approximately 50 Brinell softer than the fronthead wear ring.
 - f. Wear ring clearance adjustment shall be attained through impeller adjustment capscrews located at the end of the bearing frame.
5. **Fronthead**
- a. The fronthead shall be made of close-grained cast iron conforming to ASTM A48 CL30. It shall be cast separately (integrally on B5411) to the volute and connected to the (suction elbow)(combination base elbow).
6. **Backhead**
- a. A separately cast close-grained cast iron backhead with large access openings and integral sealing box conforming to ASTM A48 CL30 shall be provided. The sealing box shall be designed for use with conventional packing or mechanical seal without requiring re-machining. The sealing box shall be furnished with a 1/4” injection and vent tap for a clear water or grease connection to a water seal ring to prevent air from entering the pump through the sealing box.
 - b. A 3/4” minimum backhead drain tap shall be provided. Sealing box leakage will be collected by the backhead drain trough and piped directly to drain, eliminating any drippage to the floor.
 - c. A minimum of 5 rings of graphite-impregnated synthetic packing and a split Teflon water seal ring shall be furnished. Glands shall be two-piece split interlocking, made of cast iron (bronze), held in place by studs and nuts.
7. **Bearing Frame Assembly**
- a. The bearing housing shall be close-grained cast iron conforming to ASTM A48 CL30 and of heavy, rugged design for carrying the bearings and machined for accurate and permanent bearing alignment completely enclosing the shaft between the bearings. The bearing housing shall be of dust-proof design, incorporating lip-type grease seals in contact with the shaft to prevent the entrance of contaminants. Jacking bolts for external impeller adjustments are required. Zerk-type grease fittings for bearing lubrication shall be supplied at the bearing housing.

- b. The pump shaft shall be high-strength alloy steel with a minimum 100,000 PSI tensile strength and 75,000 PSI yield strength of sufficient diameter to carry the maximum loads imposed and to prevent vibration and fatigue. The shaft shall be accurately machined along its entire precision ground at bearing locations. Keyways shall be provided at both ends.
 - c. A renewable straight (tapered on C5416) shaft sleeve, positive adhesive sealed to prevent leakage between the shaft and the sleeve, shall protect the shaft through the sealing box area. The shaft sleeve shall be stainless steel with Brinell hardness of 300-350 (on mechanical seal pump shaft sleeve may be corrosion-resistant bronze).
 - d. Radial (inboard) bearings shall be (single-row on T20, T30 & T40 frames)(double-row on T60 & T80 frames) grease-lubricated ball bearings designed to carry the hydraulic radial loads encountered in the service conditions. Thrust (outboard) bearings shall be (single-row on T20 & T30 frames)(double-row on T40, T60 & T80 frames) designed to carry the pump hydraulic axial and dead load thrust.
 - e. Bearings shall be designed for an L10 life of 100,000 hours per AFBMA at best efficiency point.
8. Base and Suction Elbow
- a. A rugged, heavy-duty fabricated steel base with openings large enough to permit access to the suction elbow and cleanout, bolted directly to the volute, shall be provided. The base shall be designed to support the assembled weight of the pump and shafting..
 - b. A cast iron suction elbow with ½” gauge connection, contoured handhole cleanout, and a 125 lb. flat-faced flange conforming to ANSI drilling shall be furnished.

OR

8. Combination Base/Elbow (standard on 4”B5411C, B5412C, B5413C)
- a. A heavy duty integrally cast one-piece base and elbow made of close-grained cast iron conforming to ASTM A48 CL30 shall be provided. Base elbow is to be furnished with ½” gauge connections and handhole cleanout located 180 degrees from the suction flange. The suction flange will be a (4”)(6”) 125 lb. flat-faced flange conforming to ANI drilling.
9. Fits and Hardware
- a. The volute/casing, fronthead, backhead, and frame shall be manufactured with concentric shoulder fits to assure accurate alignment. All machined bolts, nuts, and capscrews shall be of the hex-head type and will not require the use of any special tools.
10. High Ring Base
- a. The motor high ring base shall be cast iron or fabricated steel of adequate height to permit access to the coupling and furnished with a shaft guard.
11. Vibration Limitations (Field)
- a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.
12. Testing
- a. A certified factory hydrostatic and performance test shall be performed on each pumping unit in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
 - b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

28.0 **LINE ITEM NO. 28 PUMP, HEAVY DUTY**

Make: Fairbanks Morse

Model: No. C5415 10" or City Approved Equal

28.1 **SUMMARY OF REQUIREMENT:**

Requirements for providing dry pit pumps at Metro Central WWTP Lift Station (FN 397)

28.2 **GENERAL**

28.2.1 The specifications herein state the minimum requirements of the *City/Municipality*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City/Municipality* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

28.2.2 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved substitute to Fairbanks Morse 10" C5415, S/N K4J1-02743-0 pump as interpreted by the *City/Municipality*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

28.2.3 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City/Municipality*. Based upon such inquiry, the *City/Municipality* may choose to issue an Addendum in accordance with Local Public Contract Laws.

28.2.4 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

28.2.5 Bidders must have a fully stocked parts and service facility within 50 miles of the *City/Municipality*. The *City/Municipality* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

28.2.6 Bidders, on request of the *City/Municipality*, must be prepared to review their specifications with the *City/Municipality* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City/Municipality*.

28.3 **DESIGN REQUIREMENTS**

28.3.1 The dry pit pump to pump raw unscreened wastewater at the Metro Central WWTP Lift Station (FN 397). Specification is for pump only. Pump is to be used with a 75 HP, 890 RPM

28.3.2 OPERATING FLOW (Required)	2260 GPM @ 50 ft. TDH
28.3.3 MAXIMUM NPSH _R	? Feet
28.3.4 DISCHARGE SIZE	10 in
28.3.5 SOLID DIAMETER	3 IN
28.3.6 TYPE OF SEAL	Standard Packing
28.3.7 PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

28.4 EQUIPMENT

28.4.1 CASING: Pump castings shall be cast iron conforming to ASTM A48 Class 30 ductile iron or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Casing shall be designed to allow removal of rotating elements without disturbing piping connections.

28.4.2 IMPELLERS: The pump impeller shall be non-clog designed with smooth passage to pass liquid and prevent clogging of stringy fibrous material. The impeller material type made of cast iron conforming to ASTM A48 Class 30 cast iron. Impeller shall be statistically and dynamically balanced. Impeller fastener shall be stainless steel.

28.4.3 WEAR RINGS: Shall be furnished with the impeller and case wear ring and must be fully adjustable and replaceable. Wear rings shall be constructed of stainless steel with a BHN of 300-350.

28.4.4 BEARINGS: The minimum L₁₀ bearing life shall be 50,000 hours at the best efficiency point. Bearing shall be properly sized to accommodate all, mechanical and hydraulic thrusts.

28.4.5 SHAFT SLEEVE: Shaft shall be constructed of stainless steel with a BHN of 410-484. Shaft shall be designed of sufficient size to transmit the maximum horsepower and at maximum rated motor operating speed. . It shall be protected from the pump liquid by shaft sleeve in the stuffing box area.

28.5 DELIVERY

28.5.1. Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

28.5.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

28.5.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

28.5.4 Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

28.6 TOOLS AND SPARE PARTS

28.6.1 Four (4) Operations and Maintenance manuals.

28.7 WARRANTY

28.7.1 The manufacturer shall furnish the following to the owner:

28.7.2 Shall provide one (1) year warranty from the date of final system acceptance.

28.7.3 Components failing to perform as specified by the engineer or City of Houston representative shall be replaced, repaired, or satisfactorily modified by the supplier without cost of parts or labor to the owner.

28.8 MANUFACTURERS/VENDOR SERVICES

28.8.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

28.8.1 Provide complete training and local service capability for a period of not less than one half day.

28.8.2 Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

28.8.3 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

29.0 LINE ITEM NO. 29 PUMP, HEAVY DUTY TRAILER MOUNTED W/MALE X FLANGE

Make: Godwin

Model: No. CD225M or City Approved Equal

29.1 SUMMARY OF REQUIREMENT:

Requirements for Providing Electric Driven Trash Pumps.

29.1.1 The electric driven pump shall be delivered to the owner within 4 weeks of contract commencement or as stated in the notice to proceed.

29.2 System Description

29.2.1 The electric motor driven trash pump specified in this section will be used to pump raw sewage.

29.2.2 The pump and accessories shall be supplied by the pump manufacturer.

29.2.3 The pump shall be fitted with a fully automatic priming system incorporating an air compressor, air ejector assembly, and an air/water separation tank. No water shall be required in the pump to achieve a prime. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The pump must be capable of running totally dry for periods up to 24 hours.

29.2.4 The priming system shall not use a vacuum or diaphragm pump, nor require the use of a "Foot" type valve. It shall contain no moving parts or protective float gear. A demonstration of the pumps ability to repeatedly cycle from pump/snore/repriming/pump shall be required.

29.2.5 The electric motor driven pump unit shall be mounted on a skid. Pump to be fully automatic, needing no form of adjustment on priming system. The pump shall be capable of static suction lifts to 28 feet, vertical, at sea level. It shall also be capable of operation using extended suction lines.

29.2.1 Equipment acceptance shall be contingent upon its ability to run in a completely dry condition for periods up to 24 continuous hours at full speed. This requires the draining of all residual water to initiate a dry suction starting condition. A demonstration may be required by the engineer.

29.2.2 The pump offered shall be a manufacturer's standard production model. It shall have been in continuous use by municipal and industrial owners for a minimum of five years. A list of five user contacts including contact names and telephone numbers shall be provided with the bid submittal. Failure to supply a verifiable users list will be cause for rejection of the bid.

29.3 Design Requirements

29.3.1	OPERATING SPEED (MAXIMUM)	1780 RPM
29.3.2	MINIMUM SOLIDS HANDLING SIZE	3 INCHES
29.3.3	IMPELLER DIAMETER	290 mm
29.3.4	SUCTION SIZE	8 INCHES
29.3.5	DISCHARGE SIZE	8 INCHES
29.3.6	MAXIMUM SUCTION LIFT	28 FEET
29.3.7	MAXIMUM DUTY POINT	1800 GPM AT 78' TDH
29.3.8	(INCLUDING A 20' SUCTION LIFT)	

29.4 References

29.4.1 ANSI B16.1 - Standard for Cast Iron Pipe Flanges and Flanged Fittings.

29.5 The pump shall be size 8" x 8"

29.6 Pump casting shall be cast iron. It shall be constructed so that the suction flow path is in axial alignment with the impeller eye. There shall be no turns, chambers or valves between the suction line (or inlet) and the impeller.

REVISED 05/02/15.

- 29.7 IMPELLERS: The pump impeller shall be of open non-clog type with pump out vanes on the back shroud. The impeller shall be Three-bladed of hardened cast chromium steel construction (minimum Brinell Hardness 340 HB).
- 29.8 WEARPLATES: Shall be fully adjustable and replaceable, fabricated of cast iron. Wearplate clearances shall have no relationship to the ability of the pump to achieve a prime.
- 29.9 BEARINGS AND SHAFTS: Pump shall be fitted with a bearing bracket which contains the shaft and heavy duty ball or tapered roller bearings of adequate size to withstand imposed loads. Minimum I.S.O. L10 bearing life to be 100,000 hours. Impeller shafts shall be of 1½% chromium alloy.
- 29.10 SEALS: Seals shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures to 88 psi. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for periods up to 24 hours. All metal parts shall be of stainless steel. Elastomers shall be Viton.
- 29.11 PUMP SUCTION AND DISCHARGE FLANGES: Shall be cast iron ANSI (B16.1) Class 150, raised faced.
- 29.12 PUMP GASKETS: Shall be compressed fiber and/or Teflon.
- 29.13 PUMP O-RINGS: Shall be Viton.
- 29.14 Pump shall be supplied with an integral check valve mounted on the discharge flange of the pump, allowing unrestricted flow into the impeller. The check valve shall prevent in-line return of flow when the pump is shut off. Non-return valve elastomers shall be Nitrile Rubber, and shall be field replaceable.
- 29.15 The pump drive shall be a totally enclosed, fan cooled 75 horsepower electric motor. The motor shall be rated for 75 HP at a nominal speed of 1800 RPM. Motor shall be rated for electrical power source of 230/460 Volt, 3 Phase and have TEFC enclosure rating. Electric motor shall have a cast iron housing, connection box and fan cover. The motor shaft shall be high strength steel, grade 4140. Electric motor shall be inverter duty rated with minimum of class H insulation. Motor bearings shall be deep groove ball bearings. The pump will be direct coupled to the motor. Pump and motor are connected by means of a flexible type coupling and secured to the shaft with taperlock bushings.
- 29.16 Electric motor driven pumpset shall come complete with a motor control box. The motor control shall be rated for 230/480 volt service and 105 amps full load. The motor control box shall come complete with a NEMA 3R enclosure rated for outdoor use. Enclosure shall house the motor contactor as well as a main circuit breaker with a through door handle. The enclosure shall also have terminal lugs for line power feed and motor lead connections, and line reactor. The motor control shall have a 120 volt control circuit that shall include an H-O-A switch to select manual or automatic operation, start and stop push buttons, terminals for remote start-stop operation, pump running and pump fault. The motor control box shall also have a provision for a 4-20 milliamp loop to accommodate two float assembly.
- 29.17 The pump and electric motor shall be skid mounted.
- 29.18 **Factory Painting**
Pump, electric motor, and base shall be shop primed and finish painted at the place of manufacturer. Materials and thickness for priming shall be in accordance with manufacturer's standards.
- 29.19 Trailer: The pumps and motor shall be mounted on a two wheeled, pneumatic type, single axle trailer. The chasis will be constructed of heavy-duty rolled mild steel channel of 4" x 2" x 3/16" section. Trailer shall be equipped with fenders, electric brakes, front and rear support stands, safety chains and side and rear reflectors. Trailer design shall be in compliance with applicable D.O.T. regulations.

29.20 Manufacturers Services

- 29.20.1 The manufacturer shall furnish the services of a competent factory representative to do the following:
- 29.20.2 Inspect the system prior to delivery, supervise the start up and testing of the system, and certify the system has been properly furnished and is ready for operation.
- 29.20.3 Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.

29.21 Tools and Spare Parts

- 29.21.1 The manufacturer shall furnish the following with the Electric motor driven Trash Pump System:
- 29.21.2 A recommended list of spare parts.

29.22 Warranty

- 29.22.1 The manufacturer shall furnish the following to the owner:
- 29.22.2 A copy of the electric motor manufacturer's parts and labor warranty.
- 29.22.3 A One year Parts and Labor Warranty issued by the manufacturer on the Electric motor driven Trash Pump System. This warranty must cover all pump parts, including the mechanical seal.

30.0 **LINE ITEM NO. 30 PUMP, HEAVY DUTY TRAILER MOUNTED W/MALE X FLANGE**

Make: Godwin

Model: No. CD100M or City Approved Equal

30.1 SUMMARY OF REQUIREMENT:

30.1.1 Requirements for Providing Portable Sewerage Pumps.

30.1.2 The portable pump shall be delivered to the owner within _ weeks of contract commencement or as stated in the notice to proceed.

30.2 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is equal to or superior to the specified Godwin Dri-Prime® (4") four inch skid mounted pump or equal, as interpreted by the City of Houston. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

30.3 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the City of Houston Public Works. Based upon such inquiry, the City of Houston may choose to issue an Addendum in accordance with Local Public Contract Laws.

30.4 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 8 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

30.5 Unit shall be manufactured in the United States of America.

30.6 Bidders must have a fully stocked parts and service facility within 50 miles of the City of Houston. The City shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

30.7 Bidders, on request of the City of Houston, must be prepared to review their specifications with the City and must, if requested, also be prepared to provide a unit for the convenience of the City. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the City.

30.8 The pumpset specified in this section will be used to pump *raw sewerage*.

30.9 Pump shall be fitted with a fully automatic priming system capable of repeated priming from a completely dry pump casing.

30.10 The pump and accessories shall be supplied by the pump manufacturer.

30.11 The pump offered shall be the manufacturer's standard production model. It shall have been in continuous use by municipal and industrial owners for a minimum of five years. A list of five user contacts including contact names and telephone numbers shall be provided with the bid submittal. Failure to supply a verifiable users list will be cause for rejection of the bid

DESIGN REQUIREMENTS

- 30.12 OPERATING SPEED 1800 RPM
- 30.13 MINIMUM SOLIDS HANDLING SIZE 2 INCHES
- 30.14 IMPELLER DIAMETER 220 mm
- 30.15 SUCTION SIZE 4 INCHES
- 30.16 DISCHARGE SIZE 4 INCHES
- 30.17 MAXIMUM SUCTION LIFT 28 FEET
- 30.18 MAXIMUM DUTY POINT 500 GPM AT 37' TDH
(INCLUDING A 15' SUCTION LIFT)
- 30.19 SECOND DUTY POINT 350 GPM AT 65' TDH
(INCLUDING A 25' SUCTION LIFT)

- 30.20 **REFERENCES**
ANSI B16.1 - Standard for Cast Iron Pipe Flanges and Flanged Fittings.

- 30.21 The pump shall be size 4"x4"

- 30.22 **CASING, SUCTION COVER, AND SEPARATION TANK: Pump castings shall be constructed of cast iron. It shall be constructed so that the suction flow path is in axial alignment with the impeller eye. There shall be no turns, chambers or valves between the suction line (or inlet) and the impeller.**

- 30.23 IMPELLERS: The pump impeller shall be of open non-clog type with pump out vanes on the back shroud. The impeller shall be Three-bladed of hardened cast-chromium steel construction (minimum Brinell Hardness 340 HB).

- 30.24 WEARPLATES: Shall be fully adjustable and replaceable, fabricated cast iron. Wearplate clearances shall have no relationship to the ability of the pump to achieve a prime.

- 30.25 BEARINGS AND SHAFTS: Pump shall be fitted with a bearing bracket which contains the shaft and heavy duty ball or tapered roller bearings of adequate size to withstand imposed loads. Minimum I.S.O. L10 bearing life to be 100,000 hours. Impeller shafts shall be of 1½% chromium alloy.

- 30.26 SEAL: Seal shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures to 29-psi. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for periods up to 24 hours. All metal parts shall be of stainless steel. Elastomers shall be Viton.

- 30.27 PUMP SUCTION AND DISCHARGE FLANGES: Shall be cast iron ANSI (B16.1) Class 150, raised faced.

- 30.28 PUMP GASKETS: Shall be compressed fiber and/or Teflon.

- 30.29 PUMP O-RINGS: Shall be Nitrile Rubber.

- 30.30 PRIMING SYSTEM: The pump shall be fitted with a fully automatic priming system incorporating a twin-cylinder, self lubricating air compressor, air ejector assembly, and an air/water separation tank. No water shall be required in the pump to achieve a prime. The priming system shall not use a vacuum or diaphragm pump, nor require the use of a "Foot" type valve. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The priming system shall require no fail-safe protection float gear or any adjusting at high or low suction lifts. Equipment acceptance shall be contingent upon its ability to run in a completely dry condition for periods up to 24 continuous hours at full speed. This requires the draining of all residual water to initiate a dry suction starting condition. A demonstration may be required by the engineer.

- 30.31 CHECK VALVE: Pump shall be supplied with an integral nitrile rubber ball check valve mounted on the discharge flange of the pump, allowing unrestricted flow into the impeller. This type of check valve shall prevent in-line return of flow when the pump is shut off. Non-return valve elastomers shall be nitrile rubber, and shall be field replaceable.

30.32 **DRIVE UNIT:** The pump drive shall be a totally enclosed, fan cooled 20 HP electric motor. The motor shall be rated for 20 HP at a nominal speed of 1800 RPM. Motor shall be rated for electrical power source of 60 Hz, 230/460 volt, 3 Phase, and have TEFC enclosure rating. Electric motor shall have a cast iron housing, junction box and fan cover. The motor shaft shall be high strength steel, grade 4140. Electric motor shall be inverter rated with minimum of class H insulation. Motor bearings shall be roller bearings. The pump will be direct coupled to the motor. Pump and motor are connected by means of a flexible type coupling and secured to the shaft with taperlock bushings.

30.33 Electric motor driven pumpset shall come complete with a motor control box. The motor control shall be rated for 230/480 volt service and 32 amps full load. The motor control box shall come complete with a NEMA 3R enclosure rated for outdoor use. Enclosure shall house the motor contactor as well as a main circuit breaker with a through door handle. The enclosure shall also have terminal lugs for line power feed and motor lead connections, and line reactor. The motor control shall have a 120 volt control circuit that shall include an H-O-A switch to select manual or automatic operation, start and stop push buttons, terminals for remote start-stop operation, pump running and pump fault. The motor control box shall also have a provision for a 4-20 milliamp loop to accommodate two float assembly.

30.34 The pump and electric motor shall be skid mounted.

30.35 **SKID BASE:** The pump and motor shall be mounted on a structural steel skid base, including anchor holes. The entire assembly will be fitted with a balanced, single point lifting frame.

30.36 **FACTORY PAINTING:** Pump, engine, base, and trailer shall be shop primed and finish painted at the place of manufacturer. Materials and thickness for priming shall be in accordance with manufacturer's standards.

30.37 **TRAILER:** The pump and motor shall be mounted on a two wheeled, pneumatic type, single-axle trailer. The chassis will be constructed of heavy-duty rolled mild steel channel of 4 x 2 x 3/16 section. Trailer shall be equipped with fenders, electric brakes, front and rear support stands, lifting bar, safety chains, and side and rear reflectors. Trailer design shall be in compliance with applicable D.O.T. regulations.

30.38 MANUFACTURERS SERVICES

30.38.1 The manufacturer shall furnish the services of a competent factory representative to do the following:

30.38.2 Inspect the system prior to delivery, supervise the start up and testing of the system, and certify the system has been properly furnished and is ready for operation.

30.38.3 Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.

30.39 TOOLS and SPARE PARTS

30.39.1 The manufacturer shall furnish the following with the Portable Trash Pump System:

30.39.2 A recommended list of spare parts.

30.40 WARRANTY

30.40.1 The manufacturer shall furnish the following to the owner:

30.40.2 A copy of the engine manufacturer's parts and labor warranty.

30.40.3 A One year Warranty issued by the manufacturer on the Portable Trash Pump System. This warranty must cover all pump parts, including the mechanical seal.

31.0 **LINE ITEM NO. 31 PUMP, HEAVY DUTY TRAILER MOUNTED W/MALE X FLANGE**

Make: Godwin

Model: No. CD150M or City Approved Equal

31.1 **SUMMARY OF REQUIREMENT:**

The electric motor driven trash pump specified in this section will be used to pump raw sewage.

31.2 The pump and accessories shall be supplied by the pump manufacturer.

31.2.1 The pump shall be fitted with a fully automatic priming system incorporating an air compressor, air ejector assembly, and an air/water separation tank. No water shall be required in the pump to achieve a prime. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The pump must be capable of running totally dry for periods up to 24 hours.

31.2.2 The priming system shall not use a vacuum or diaphragm pump, nor require the use of a "Foot" type valve. It shall contain no moving parts or protective float gear. A demonstration of the pumps ability to repeatedly cycle from pump/snore/repriming/pump shall be required.

31.3 The electric motor driven pump unit shall be mounted on a skid.

31.3.1 Pump to be fully automatic, needing no form of adjustment on priming system. The pump shall be capable of static suction lifts to 28 feet, vertical, at sea level. It shall also be capable of operation using extended suction lines.

31.3.2 Equipment acceptance shall be contingent upon its ability to run in a completely dry condition for periods up to 24 continuous hours at full speed. This requires the draining of all residual water to initiate a dry suction starting condition. A demonstration may be required by the engineer.

31.3.3 The pump offered shall be a manufacturer's standard production model. It shall have been in continuous use by municipal and industrial owners for a minimum of five years. A list of five user contacts including contact names and telephone numbers shall be provided with the bid submittal. Failure to supply a verifiable users list will be cause for rejection of the bid.

	OPERATING SPEED (MAXIMUM)	1780 RPM
31.4	MINIMUM SOLIDS HANDLING SIZE	3 INCHES
31.5	IMPELLER DIAMETER	280 mm
31.6	SUCTION SIZE	6 INCHES
31.7	DISCHARGE SIZE	6 INCHES
31.8	MAXIMUM SUCTION LIFT	28 FEET
31.9	MAXIMUM DUTY POINT	1300 GPM AT 78' TDH
31.10	(INCLUDING A 15' SUCTION LIFT)	

31.11 ANSI B16.1 - Standard for Cast Iron Pipe Flanges and Flanged Fittings.

31.12 Equipment

- 31.12.1 The pump shall be size 6" x 6"
- 31.12.2 Pump casting shall be cast iron. It shall be constructed so that the suction flow path is in axial alignment with the impeller eye. There shall be no turns, chambers or valves between the suction line (or inlet) and the impeller.
- 31.12.3 IMPELLERS: The pump impeller shall be of open non-clog type with pump out vanes on the back shroud. The impeller shall be Three-bladed of hardened cast chromium steel construction (minimum Brinell Hardness 340 HB).
- 31.12.4 WEARPLATES: Shall be fully adjustable and replaceable, fabricated of cast iron. Wearplate clearances shall have no relationship to the ability of the pump to achieve a prime.
- 31.12.5 BEARINGS AND SHAFTS: Pump shall be fitted with a bearing bracket which contains the shaft and heavy duty ball or tapered roller bearings of adequate size to withstand imposed loads. Minimum I.S.O. L10 bearing life to be 100,000 hours. Impeller shafts shall be of 1½% chromium alloy.
- 31.12.6 SEALS: Seals shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures to 88 psi. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for periods up to 24 hours. All metal parts shall be of stainless steel. Elastomers shall be Viton.
- 31.12.7 PUMP SUCTION AND DISCHARGE FLANGES: Shall be cast iron ANSI (B16.1) Class 150, raised faced.
- 31.12.8 PUMP GASKETS: Shall be compressed fiber and/or Teflon.
- 31.12.9 PUMP O-RINGS: Shall be Viton.
- 31.12.10 Pump shall be supplied with an integral ball check valve mounted on the discharge flange of the pump, allowing unrestricted flow into the impeller. The check valve shall prevent in-line return of flow when the pump is shut off. Non-return valve elastomers shall be Nitrile Rubber, and shall be field replaceable.
- 31.12.11 The pump drive shall be a totally enclosed, fan cooled 50 horsepower electric motor. The motor shall be rated for 50 HP at a nominal speed of 1800 RPM. Motor shall be rated for electrical power source of 230/460 Volt, 3 Phase and have TEFC enclosure rating. Electric motor shall have a cast iron housing, connection box and fan cover. The motor shaft shall be high strength steel, grade 4140. Electric motor shall be inverter duty rated with minimum of class H insulation. Motor bearings shall be deep groove ball bearings. The pump will be direct coupled to the motor. Pump and motor are connected by means of a flexible type coupling and secured to the shaft with taperlock bushings.

31.12.12 Electric motor driven pumpset shall come complete with a motor control box. The motor control shall be rated for 230/480 volt service and 70 amps full load. The motor control box shall come complete with a NEMA 3R enclosure rated for outdoor use. Enclosure shall house the motor contactor as well as a main circuit breaker with a through door handle. The enclosure shall also have terminal lugs for line power feed and motor lead connections, and line reactor. The motor control shall have a 120 volt control circuit that shall include an H-O-A switch to select manual or automatic operation, start and stop push buttons, terminals for remote start-stop operation, pump running and pump fault. The motor control box shall also have a provision for a 4-20 milliamp loop to accommodate two float assembly.

31.12.13 The pump and electric motor shall be skid mounted.

31.13 Factory Painting

31.13.1 Pump, electric motor, and base shall be shop primed and finish painted at the place of manufacturer. Materials and thickness for priming shall be in accordance with manufacturer's standards.

31.13.2 Trailer: The pumps and motor shall be mounted on a two wheeled, pneumatic type, single axle trailer. The chasis will be constructed of heavy-duty rolled mild steel channel of 4" x 2" x 3/16" section. Trailer shall be equipped with fenders, electric brakes, front and rear support stands, safety chains and side and rear reflectors. Trailer design shall be in compliance with applicable D.O.T. regulations.

31.14 Manufacturers Services

31.14.1 The manufacturer shall furnish the services of a competent factory representative to do the following:

31.14.2 Inspect the system prior to delivery, supervise the start up and testing of the system, and certify the system has been properly furnished and is ready for operation.

31.14.3 Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.

31.15 Tools and Spare Parts

31.15.1 The manufacturer shall furnish the following with the Electric motor driven Trash Pump System:

31.15.2 A recommended list of spare parts.

31.16 Warranty

31.16.1 The manufacturer shall furnish the following to the owner:

31.16.2 A copy of the electric motor manufacturer's parts and labor warranty.

31.16.3 A One year Parts and Labor Warranty issued by the manufacturer on the Electric motor driven Trash Pump System. This warranty must cover all pump parts, including the mechanical seal.

32.0 LINE ITEM NO. 32 PUMP, HEAVY DUTY ELECTRIC, SKID MOUNTED W/1 MANUAL CONTROL PANEL

Make: Godwin

Model: No. CD103M or City Approved Equal

32.1 SUMMARY OF REQUIREMENT:

32.1.1 Requirements for providing electrically driven trash pump for Sims North WWTP

32.1.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

32.1.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved substitute to a Godwin, CD103M, 4" x 4" pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require a reply with an explanation at each deviation or substitution

32.1.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

32.1.5 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

32.1.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.

32.1.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

32.2	MAXIMUM OPERATING FLOW (Required)	700 GPM @ 65 ft. TDH
32.3	SUCTION LIFT AT MAXIMUM OPERATING FLOW	15 Feet
32.4	MAXIMUM SUCTION LIFT	28 FEET
32.5	SUCTION SIZE	4 in
32.6	DISCHARGE SIZE	4 in
32.7	FULL LOAD AMPS	42 amp
32.8	SOLID DIAMETER	3 IN
32.9	PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

32.10 The electrically driven trash pump for Sims North WWTP is to be used to pump sludge to the CHC tank that feeds the Beltpress. Two eccentric 4"x6" increasers shall be provided.

32.11 EQUIPMENT

31.12.1 CASING: Pump castings shall be cast iron. Thickness and weight shall insure long life, accurate alignment and reliable operation in the wastewater environment.

31.12.2 IMPELLERS: The pump impeller shall be of open non-clog designed with smooth passage to pass liquid and prevent clogging of stringy fibrous material. The impeller shall be made of chromium steel with a minimum Brinell Hardness 340 HB.

31.12.3 WEARPLATES: Shall be fully adjustable and replaceable. Wear plate clearance shall have no effect on the priming ability of the pump.

31.12.4 BEARINGS AND IMPELLER SHAFT: The minimum L₁₀ bearing life shall be 100,000 hours at the best efficiency point. Bearings shall be properly sized to withstand all imposed loads. Impeller shaft shall be of 1.5% chromium steel.

31.12.5 SEALS: Seals shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures of 88 psi. The seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustments. All metal parts shall be stainless steel.

32.12 MOTOR and MOTOR CONTROL: Shall be a totally enclosed, fan cooled (TEFC), 30 Horsepower electric motor. Motor shall be inverter duty motor with a minimum insulation class H. Motor shall be rated for 30 HP at a nominal speed of 1800 RPM. Motor shall have cast iron housing, connection box and fan cover. Motor shaft shall be of high strength steel, grade 4140. Pump shall be directly coupled to the motor. Pump and motor shall be connected by means of flexible coupling and secure to shaft with taper lock bushings. Motor shall have a NEMA 3R enclosure rated for outdoor use. Enclosure shall house the motor contactor and the main circuit breaker with a through door handle. Enclosure shall have terminal lugs for line power feed, motor lead connections and line reactor. Motor control shall have a 120 volt control circuit that shall include H-O-A switch to select manual or automatic operation, start and stop push buttons, terminals for remote start-stop operation, pump running and pump fault. The motor control box shall also have a provision for a 4-20 milliamp loop to accommodate two float assembly. Pump and motor shall be mounted on a grout ready skid.

32.13 DISCHARGE AND SUCTION FLANGES: Shall be cast iron ANSI class 150 or better. Two 4"x 6" eccentric increasers shall be provided. Pump shall be provided with an integral check valve mounted on the discharge flange of the pump to allow unrestricted flow to the impeller but prevent return of flow when pump is shut-off.

32.14 PRIMING: Pump shall be fitted with a fully automatic priming system incorporating an air compressor, air ejector assembly, and an air/water separation tank. No water shall be requires to achieve a prime. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The priming system shall not use a vacuum or diaphragm pump, nor require the use of "Foot" type valve. It shall contain no moving parts or protective float gear. Pump to be fully automatic, needing no form of adjustment on priming system. The pump shall be capable of static suction lifts to 8 feet, vertical, at sea level. It shall be capable of operation using extended suction lines.

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32.15 2.1.11 PERFORMANCE AND ENVIRONMENT: Pump, motor and cable shall be designed for continuous dry conditions with no damage for periods up to 24 hours. Pump shall be able to withstand the wastewater environment. Pump, electric motor, and base shall be shop primed and finish painted at the place of manufacturer.

32.16 DELIVERY

32.16.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

32.16.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

32.16.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

32.16.4 Vendor shall be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

32.16.5 Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

32.17 TOOLS AND SPARE PARTS

Four (4) Operations and Maintenance manuals.

32.18 WARRANTY

32.18.1 The manufacturer shall furnish the following to the owner:

32.18.2 Shall provide one (1) year warranty from the date of final system acceptance.

32.19 MANUFACTURERS/VENDOR SERVICES

The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

32.19.1.1 Provide complete training and local service capability for a period of not less than one half day.

32.19.1.2 Be present during installation and/or start-up of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and test and certify the system has been properly furnished and is ready for operation.

32.19.1.3 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

33.0 LINE ITEM NO. 33 PUMP, HEAVY DUTY

Make: Vaughan

Model: No. S3G-065 or City Approved Equal

33.1 SUMMARY OF REQUIREMENT:

Requirements for providing a submersible scum pit pump at WCID#47 WWTP

33.2 The specifications herein state the minimum requirements of the *City/Municipality*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The City may consider as “irregular” or “non-responsive”, any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City/Municipality* to make a reasonable determination of compliance to the specification. It shall be the bidder’s responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as “non-responsive”. All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

33.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved substitute to S3GNRG-065 Vaughan Pump, 5 HP, 150 GPM @30ft. TDH pump as interpreted by the *City/Municipality*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation at each deviation or substitution.

33.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City/Municipality*. Based upon such inquiry, the *City/Municipality* may choose to issue an Addendum in accordance with Local Public Contract Laws.

33.5 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year’s production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

33.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City/Municipality*. The *City/Municipality* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

33.7 Bidders, on request of the *City/Municipality*, must be prepared to review their specifications with the *City/Municipality* and must do so, if requested. These services, if needed are considered as part of the bidder’s proposal and will be provided without cost or obligation to the *City/Municipality*.

33.8 The submersible pump is to be used to pump waste solids at heavy consistency such as but not limited to the following paper products, plastics , diapers, heavy rags, grease, hair balls, and stringy materials.

33.9 Operating Flow (Required)	150 GPM 30feet TDH
33.10 Voltage	460 V
33.11 Motor HP and Speed	5 HP and 1750 RPM
33.12 Power Cable(s)	25 feet
33.13 Frequency	60 Hz
33.14 Discharge size	4 inch
33.15 PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION. PUMP MUST FIT EXISTING GUIDE RAIL SYSTEM.	

- 33.16 CASING and VOLUTE: Pump castings shall be ductile iron or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Volute shall be designed to be smooth and free of blowholes and imperfections. Volute shall be designed to ensure passage of waste solids.
- 33.17 IMPELLERS: The pump impeller shall be semi-open chopper type with smooth passage to pass waste solids at heavy consistency such as but not limited to the following paper products, plastics, diapers, heavy rags, grease, hair balls, and stringy materials. Impeller shall also be able to withstand solids, fibrous material, wastewater sludge and other material present in wastewater. The impeller shall be made of cast steel and have a minimum Rockwell C Hardness of 60. Impeller shall be designed to chop and macerate waste products mentioned above. Rotation of the impeller shall be secured via a shaft key or other locking mechanism. Impeller shall not extend beyond past the cutter bar.
- 33.18 CUTTER BAR: Cutter bar shall be single cast component recessed into pump bowl. Set clearance between the cutter bar and impeller shall be adjustable between .005 inch to .02" inch. Cutter bar shall be cast steel heat treated to a minimum 60 Rockwell C Hardness.
- 33.19 UPPER CUTTER and CUTTER NUT: The upper cut shall consist of no more than 2 cutting anvils to minimize the potential for binding. Cutter nut shall be used to affix the impeller to the shaft and to eliminate binding or wrapping if stringy materials at the pump inlet. The set clearance between the impeller and the upper cutter shall be adjustable to .010 inches or less. The upper cutter and cutter nut shall be replaceable, made of cast steel and shall have a minimum Rockwell C Hardness of 60.
- 33.20 BEARINGS AND SHAFT: Bearing housing shall be ductile iron. Bearings must be permanently lubricated and rated in accordance with Anti-Friction Bearing Manufacturers Association for a minimum L₁₀ bearing life of 100,000 hours at the best efficiency point. Inboard bearing shall be suitable for radial loads. Outboard bearing shall be capable of taking axial load in either direction as well as radial load to counter the moment on the shaft. Shaft shall be closed coupled directly to the pump shaft is using a solid sleeve coupling.
- 33.21 MOTOR: The submersible motor shall be rated at 5 HP, 1750 RPM, 460 Volts, and 3 phase, with a 1.0 service factor and Class F insulation. Motor shall be supplied with 25 feet of power and control cables. The frequency of the motor shall be 60 hertz and winding shall be insulation class F or better. Motor must be designed specifically for submersible pump usage (water tight). Motor shall be non-overloading for the entire range of the operating curve within the name plate and shall be capable of no less than 10 evenly spaced starts per hour. Motor shall be rated for continuous-in-air operation.
- 33.22 SEAL: Each pump shall be provided with a tandem mechanical shaft seal system. The seal shall contain silicon-carbide faces .The upper seal set shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal shall be exposed to the lubricant in the bearing housing with no exposure to the pumpage. Seals shall rest on a 316 stainless steel shaft sleeve with seal tension held by 3 set screws.
- 33.23 PROTECTION: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped in the end of the coils of the stator winding .These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. The pump shall be equipped with moisture sensors in the oil filled seal chamber to indicate seal leakage. Surface material is to be sandblasted and finished coated with epoxy.

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33.24 **COOLING:** Cooling shall be provided to allow pump to be cooled while pumpage level is at the top of volute. Motor shall be rated for continuous-in-air operation.

33.25 **ENVIRONMENT:** Pump, motor and cable shall be designed for continuous submersible use without loss of water tight integrity.

33.26 DELIVERY

33.26.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

33.26.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

33.26.3 The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

33.26.4 Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

33.27 TOOLS AND SPARE PARTS

33.27.1 2 Kellems Grips shall be provided

33.27.2 4 O&M (Operations and Maintenance manuals).

33.28 WARRANTY

33.28.1 The manufacturer shall provide the following to the owner:

33.28.2 One (1) year warranty from the date of final system acceptance.

33.28.3 Components failing to perform as specified by the engineer or City of Houston representative shall be replaced, repaired, or satisfactorily modified by the supplier without cost of parts or labor to the owner.

33.29 MANUFACTURERS/VENDOR SERVICES

33.29.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

33.29.2 Provide complete training and local service capability for a period of not less than one half day.

33.29.3 Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

33.29.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

34.0 **LINE ITEM NO. 34 PUMP, HEAVY DUTY**

Make: Vaughan

Model: No. S3L-080 or City Approved Equal

34.1 SUMMARY OF REQUIREMENT:

Requirements for providing a Submersible Chopper Pump for Scum Removal System for the Sims Bayou North WWTP.

34.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

34.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of the Submersible Chopper Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

34.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

34.5 GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.

34.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

34.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

34.8 EQUIPMENT

Vaughan Chopper Pump Model S3L-080

34.9 Pump assembly shall be a wet well vertically mounted chopper pump capable of macerating and conditioning sewage and scum materials.

34.10 Pump shall be rated for wastewater applications

34.11 Pump performance rating shall be 100 gpm @ 45 ft. of TDH

34.12 Pump motor shall be 7.5 hp 460 V , 60 Hz, 1750 RPM, 1.0 SF, explosion proof (Class 1, Group D), continuous in air submersible motor with tandem mechanical seals, moisture sensors, internal thermostats and 50 ft of power cord manufactured by Baldor. Starts per hour per NEMA standards.

34.13 Casing shall be ductile iron with 3" 125 Lb., ANSI rated discharge flange

34.14 Impeller, cutter bar, upper cutter and cutter nut shall be heat treated to a minimum 60 Rockwell C hardness.

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34.15 Seal(s) shall be mechanical, cartridge type with SC or TC faces and designed to ride on 316 stainless shaft sleeve. The seal flatness shall be tested using Helium light source and confirmed to be optically flat within to two Helium light bands ie. about 0.000011 inches times two.

34.16 Pump must fit the existing guide rail systems without modification and it shall be furnished with a 3" ductile iron guide rail sliding bracket that will fit the existing guide rail system without modification.

34.17 Cutter bar shall be a single cast component. The set clearance between the cutter and impeller shall be adjustable to .005" to .020".

34.18 The upper cutter shall be a replaceable item and separate from the casing back plate. The upper cutter shall be heat treated to a minimum 60 Rockwell C hardness.

34.19 The pump stub shaft and impeller shall be supported by ball bearings and the shaft shall be constructed of heat treated steel with a minimum diameter of 1.5".

34.20 The bearing housing shall be constructed of ductile cast iron

34.21 The shaft's bidirectional thrust shall be carried by two back-to-back mounted single-row angular contact ball bearings. A secondary mechanical seal shall be employed to isolate the bearings from the pumped media. The secondary seal and thrust bearings shall be oil bath lubricated and rated at a minimum for 100,000 duty hours.

34.22 The pump shall come equipped with an automatic oiling and oil level monitoring system. The oil level monitoring reservoir will be mounted on the top of the wet well and supplied with a 50 ft. of connecting hose. The oil system shall have an automatic cut off switch to shut the pump in the event of a low oil event. A 150 ft. of cable hard wired to the automatic oil monitor cap shall be provided.

34.23 The submersible motor shall be close coupled directly to the pump shaft with a solid sleeve coupling, keyed at both the pump and motor. Slip clutches and shear pin connections between shaft and motor will not be considered. The submersible motor shall be rated at 7.5 HP, 1750 RPM, 460 Volts, 60 Hertz, 3 phase, with a 1.0 service factor and Class F insulation. Motor shall have tandem mechanical seals in oil bath and dual moisture sensing probes. The motor shall be rated for continuous-in-air operation and provided with 50 feet of motor power and control cable.

34.23 A stainless steel nameplate with the manufacturer's displaying the model name, serial number, and ratings/performance parameters is required.

34.24 DELIVERY

34.25.1 Entire assembled units shall be delivered to Cullen Service Center, 7440 Cullen Blvd., Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

34.25.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

34.25.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

34.25 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

34.26 WARRANTY

34.26.1 The manufacturer shall furnish the following to the owner:

34.27.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for

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the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

34.27.3 In the event of a warranty claim, the City will make the electrical disconnects at the site and will make the electrical reconnections at the site

35.0 **LINE ITEM NO. 35 PUMP, HEAVY DUTY**

Make: Vaughan

Model: No. S3G-065 or City Approved Equal

35.1 SUMMARY OF REQUIREMENT:

Requirements for providing a Submersible Chopper Pump model #S3L-079 for Sims South WWTP.

- 35.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 35.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of a Vaughan Submersible Chopper Pump model #S3G-065 as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 35.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 35.5 GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.
- 35.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 35.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.
- 35.8 **EQUIPMENT**
Vaughan Chopper Pump Model S3G-065
- 35.9 Pump assemble shall be a wet well vertically mounted chopper pump capable of macerating and conditioning sewage and scum materials.
- 35.10 Pump shall be rated for wastewater applications
- 35.11 Pump performance rating shall be 280 gpm @ 26 ft. of TDH
- 35.12 Pump motor shall be 5 hp, three phase, 460 V, 60 Hz, 1750 rpm, 1.0 SF, explosion proof (Class1, Group D). continuous in air submersible motor with tandem mechanical seals, moisture sensors, internal thermostats, and 50ft. of power cable, manufactured by Baldor.
- 35.13 Casing shall be ductile iron with 3" 125 Lb. ANSI rated discharge flange connection to match exiting field piping

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- 35.14 Impeller, cutter bar, upper cutter and cutter nut shall be cast steel, heat treated to a minimum 60 Rockwell C hardness. The impeller shall be dynamically balanced.
- 35.15 Seal(s) shall be mechanical, cartridge type with silicon carbide faces, as manufactured by Vaughan.
- 35.16 Pump must fit the existing guide rail systems without modification and it shall be furnished with a 3" ductile iron guide rail sliding bracket that will fit the existing guide rail system without modification.
- 35.17 Bearings shall be, oil bath lubricated ball type and bearing housing shall be cast ductile iron.
- 35.18 The pump shaft and impeller shall be supported by ball bearings and the shaft shall be constructed of heat treated steel with a minimum diameter of 1.5".
- 35.19 The bearing housing shall be constructed of ductile cast iron
- 35.20 Shaft thrust shall be taken up by either a double row angular contact ball bearing or two back-to-back mounted single row angular contact ball bearings, which bear against a machined shoulder on one side and the seal sleeve on the other side. Overhang from the centerline of the lower thrust bearing to the seal faces shall be a maximum of 1.2". Shaft overhang exceeding 1.2 inches from center of lower thrust bearing to seal faces shall be considered unacceptable. A mechanical seal shall isolate the bearings from the pumped media at operating temperatures to 250 F.
- 35.21 The lower motor seal shall be exposed only to the lubricant in the bearing housing, with no exposure to the pumpage. Motor shall include two normally closed automatic resetting thermostats connected in series and imbedded in adjoining phases. Motor frame shall be cast iron, and all hardware and shaft shall be stainless steel. Pump designs where the lower motor mechanical seal is exposed to the pumpage, will allow for pumpage to contaminate the submersible motor in the event of a lower motor seal failure. Therefore, designs where the lower motor seal is exposed to the pumpage will not be allowed on this project.
- 35.22 Hard-Wired Automatic Oil Level Monitor: A clear PVC oil reservoir with float switch shall be mounted at the top of the wet well, with 50 feet of hose feeding down to the side of the bearing housing to detect oil level and shut off the motor in event of low oil level. A sensitive relay shall be included for mounting in the motor control panel. In addition, 150 feet of cable, hard-wired to the automatic oil monitor cap shall be provided by the pump manufacturer.
- 35.23 The submersible motor shall be close coupled directly to the pump shaft with a solid sleeve coupling, keyed at both the pump and motor. Slip clutches and shear pin connections between shaft and motor will not be considered.
- 35.24 A stainless steel nameplate with the manufacturer's displaying the model name, serial number, and ratings/performance parameters is required.
- 35.25 **DELIVERY**
- 35.25.1 Entire assembled units shall be delivered to Cullen Service Center, 7440 Cullen Blvd., Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 35.25.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 35.25.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 35.25.4 Final Delivery details should also be coordinated with Gurdip Hyare (Phone # 832-395-5459).
- 35.26 **TOOLS AND SPARE PARTS**
- (4) Operations and Maintenance manuals.

35.27 WARRANTY

35.27.1 The manufacturer shall furnish the following to the owner:

35.27.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

LINE ITEM NO. 36 PUMP, HEAVY DUTY

Make: Vaughan

Model: No. SP4C-089 or City Approved Equal

36.1 SUMMARY OF REQUIREMENT:

Greenridge WWTP self-priming chopper pump shall be a centrifugal pump specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Materials shall be chopped/macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications. Produces 300 GPM @ 20 FT. TDH

36.2 Housing: Shall include 125 lb. 4"flanged inlet and 4"discharge flanges, an oversized cleanout and mounting feet. The housing shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics.

36.3 Casing and Back Pull-Out Plate: The pump casing shall be of volute design, spiraling outward to the 125 lb. flanged centerline discharge. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of casing from inlet or discharge piping. Casing & back plate shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics. A pressure tap shall be included on or near the discharge flange. Back plate shall include a replaceable Rockwell C 60 steel cutter adjustable for 0.005-0.015" clearance to cut against the rotating impeller pump out vanes for removing fiber and debris. Casing shall be a separate parts component of the housing.

36.4 Impeller: Shall be 8.9" diameter semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a maximum set clearance between the impeller and cutter bar of 0.015-0.025" cold. Impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be threaded to the shaft and shall have no axial adjustments and no set screws.

36.5 Cutter Nose: Designed to cut stringy materials and prevent binding using two opposing cutter edges that cut against the inside of the cutter bar fingers. The cutter nose shall be cast steel heat treated to minimum Rockwell C 60.

36.6 Cutter Bar: Shall be recessed into the pump bowl, and shall extend diametrically across entire pump suction opening. Cutter bar shall be alloy steel and heat treated to minimum 60 Rockwell C Hardness.

36.7 Upper Cutter: Shall be threaded into the back plate behind the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area. Upper cutter shall be cast steel and heat treated to minimum 60 Rockwell C Hardness.

36.8 Pump Shafting: Shall be heat treated alloy steel.

36.9 Bearings: Shall be oil bath lubricated with ISO Gr. 100 turbine oil and site glass indication. Shaft thrust in both directions shall be taken up by a double-row angular contact ball bearing. A single-row radial bearing shall also be provided. B10 bearing life shall be minimum 100,000 hours.

- 36.10 Back Pull-Out Bearing Housing: Shall be ductile cast iron, and machined with piloted bearing fits for concentricity of all components. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of housing from inlet or discharge piping. Viton® double lip seals riding on a stainless steel shaft sleeve shall provide sealing at the drive end of the bearing housing.
- 36.11 Mechanical Seal: Mechanical seal shall be cartridge type with silicon carbide (or tungsten carbide) faces. Seal shall be positively driven by set screws. Elastomers shall be Viton. This cartridge seal shall be a preassembled, and pre-tested so that no seal settings or adjustments are required from the installer. Any springs used to push the seal faces together must be shielded from the fluid to be pumped. The cartridge shall also include a 17-4PH, heat-treated seal sleeve and a CF8M stainless steel seal gland.
- 36.12 Shaft Coupling: Bearing housing and motor stool design is to provide accurate, self-aligning mounting for a C-flanged electric motor. Pump and motor coupling shall be T.B. Woods Sureflex elastomeric type.
- 36.13 Optional Belt Drive: Adjustable brackets shall be used to support a side-mounted motor. Sheaves and belts shall be properly sized for horsepower ratings, and all guards are to be supplied with the belt drive system.
- 36.14 Stainless Steel Nameplates: Shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.
- 36.15 Motor Requirements: Drive motor shall be 5 HP, 1750 RPM, 230/460 volts, 3 phase, 60 hertz, C-flange mounted, TEFC enclosure. The motor shall be sized for non-overloading conditions. Degreased and coated with an acrylic urethane (except motor).
- 36.16 OPTIONAL ADDER Surface Preparation: SSPC-SP5 commercial sandblast, primed with 3 MDFT zinc-filled primer and finish coated with 3 MDFT epoxy (except Motor).

37.0

LINE ITEM NO. 37 PUMP, HEAVY DUTY SUBMERSIBLE SEWAGE

Make: KSB

Model: No. 100-250/194xg or City Approved Equal

37.1

SUMMARY OF REQUIREMENT:

Requirements for providing electrically Submersible Wet Pit Pumps (Scum Pumps) for the Northwest WWTP lift station, 5423 Mangum Rd., Houston, TX.

37.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

37.3 **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved substitute to a KSB, Electric Submersible Solids Handling Pumps (Model: F 100-250/194XG, 25 HP, 460 V, with 50' Power Cables, Lifting Bails, Claws and 30' SS Lifting Chains Per Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require a reply with an explanation at each deviation or substitution.

37.4 **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

37.5 **GENERAL SPECIFICATIONS:** Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

37.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.

37.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

37.8 Electric Submersible Solids Handling Pumps to be used to remove scum from a scum pit.

37.9	OPERATING CONDITIONS	N/A GPM @ N/A TDH
37.10	MINIMUM SHUTOFF HEAD	101 FT
37.11	MAXIMUM MOTOR HP	25 HP
37.12	MINIMUM HYDRAULIC EFF. (@ Design)	53.9 % @ BEP
37.13	MAXIMUM MOTOR RPM	1750 RPM
37.14	FULL LOAD AMPS	N/A
37.15	VOLTAGE	460 VOLTS 60 HZ
37.16	SOLID DIAMETER	3 IN
37.17	SUCTION SIZE : 4 INCH	
37.18	DISCHARGE SIZE: 4 INCH	
37.19	PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

37.20 **POWER CABLE:** Provide 50 ft of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/ terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

37.21 **TEMPERATURE PROTECTION:** Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer.

37.22 **SEAL LEAK DETECTION:** Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, on motors 80HP and larger provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

37.23 **“PumpSafe” MOTOR SENSOR MONITORING RELAY:** The pump supplier shall furnish all relays required for monitoring all motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt, and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.

37.24 Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "status OK"; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both "test" and "reset" pushbuttons.

37.25 An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 5 amps at 120 volt.

37.26 IMPELLER AND WEAR RINGS- SINGLE VANE OR MULTIVANE ENCLOSED TYPE:

Provide non-clog type impeller, capable of passing at minimum a 3" spherical solid. Statically and dynamically balance the impeller. On enclosed impeller designs, provide hard metal wear rings of material and Brinell hardness specified, to insure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (i.e. bronze, 304 or 316 stainless) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

37.27 **SHAFT:** Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. Machine the shaft of carbon steel (for maximum strength and motor efficiency) and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Do not use carbon steel as shaft material without a stainless steel sleeve. If a sleeve is not used, machine the entire pump/motor shaft of ASTM A276 Type 420 stainless steel.

37.28 **SHAFT SEAL:** Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

37.29 **BEARINGS:** Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump.

37.30 **MOTOR:** Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104° F (40° C) [optional: 140°F (60° C)]. Allowable maximum submergence shall not be less than 100ft (30 m). The motor stator shall be wound using Class H monomer-free polyester resin insulation resulting in an overall motor rating of 311 Degrees F (155 degrees C), Class F insulation. The stator windings shall be trickle impregnated resulting in a winding fill factor of at least 95%. The use of a multiple step “dip and bake” type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described in section above. Provide adequately rated motor with sufficient surface area for ambient only cooling suited for the intermittent mode of operation in wet well wastewater applications, submerged or partially submerged, without damage. Motors containing di-electric oils used for motor cooling and/or bearing lubrication or motors where the pumped media or externally provided fresh water is directed through the motor shell for cooling are not acceptable.

37.31 Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code

37.32 **GENERAL:** Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump manufacturer. For guide pipe systems the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to 5 degree misalignment from vertical, pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but MUST be supplied where needed to maintain perfect alignment for pipe guides. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well. Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 83% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

37.33 Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities.

37.34 Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow.

37.35 Pump Case: Cast Iron, ASTM A48, Class 35B

37.36 Motor Housing: Cast Iron, ASTM A48, Class 35B

37.37 Impeller: Cast Iron, ASTM A48, Class 35B

37.38 Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B

37.39 Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B

37.40 Pump/Motor Shaft: Carbon Steel, ASTM A576, Gr.1045 with replaceable ASTM A276 Type 420 shaft protection sleeve. (NOTE: If sleeve is not supplied, entire shaft is to be ASTM A276 Type 420 stainless steel)

37.41 Shaft Sleeve (if used): Stainless Steel, ASTM A276 Type 420

37.42 Wear Ring, case: Cast Iron, ASTM A48, minimum 200 Brinell

37.43 Wear Ring, impeller (enclosed impellers only): Stainless Steel, AISI329, 350 Brinell

37.44 O-Rings: Nitrile Rubber (NBR)

- 37.45 Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 316Ti.
- 37.46 Lower Seal Faces: Silicon Carbide/Silicon Carbide
- 37.47 Upper Seal Faces: Silicon Carbide stationary/Carbon rotating
- 37.48 Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 316 (cables shall be nylon coated)
- 37.49 Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316
- 37.50 Oil-all uses (seal lubrication, etc): Ecologically safe, parafin or mineral base
- 37.51 Power/Control Cable Jacket: Chloroprene with non-wicking fillers

37.52 QUALITY ASSURANCE - REFERENCED STANDARDS:

- 37.52.1 American Iron & Steel Institute (AISI)
- 37.52.2 American Society for Testing and Materials (ASTM)
- 37.52.3 Factory Mutual (FM)
- 37.52.4 Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)
- 37.52.5 National Fire Protection Agency (NFPA)
- 37.52.6 National Electric Code(NEC)
- 37.52.7 National Electrical Manufacturers Association(NEMA)
- 37.52.8 Anti-Friction Bearing Manufacturers Association(AFBMA)
- 37.52.9 International Standards Organization (ISO) -

37.53 DELIVERY

37.53.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

37.53.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

37.53.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

37.53.4 Vendor shall be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

37.53.5 Final Delivery details should also be coordinated with Mr. Rosendo Morales, 7440 Cullen, Houston, Texas 77051 (Phone # 713-569-7357).

37.54 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

37.55 WARRANTY

37.55.1 The manufacturer shall furnish the following to the owner:

37.55.2 Shall provide one (1) year warranty from the date of final system acceptance.

37.56 MANUFACTURERS/VENDOR SERVICES

37.52.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request.

37.52.2 Provide complete training and local service capability for a period of not less than one half day.

37.52.3 Be present during installation and/or start-up of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and test and certify the system has been properly furnished and is ready for operation.

37.52.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

38.0 **LINE ITEM NO. 38 PUMP, HEAVY DUTY**
Make: KSB
Model: No. KRT K 200-316/266xg or City Approved Equal

38.1 SUMMARY OF REQUIREMENT:

Requirements for providing electrically Submersible Wet Pit Pumps (Scum Pumps) for the Northwest WWTP lift station, 5423 Mangum Rd., Houston, TX.

38.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as “irregular” or “non-responsive”, any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder’s responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as “non-responsive”. All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

38.3 **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved substitute to KSB 8” Electric Submersible Solids Handling Pumps (Model: K 200-316/266XG, 32 HP, 460 V, with 50’ Power Cables, Lifting Bails, Claws and 30’ SS Lifting Chains Per Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require a reply with an explanation at each deviation or substitution.

38.4 **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

38.5 **GENERAL SPECIFICATIONS:** Units described shall be new, unused and of the current year’s production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

38.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.

38.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder’s proposal and will be provided without cost or obligation to the *City of Houston*.

38.8 DESIGN REQUIREMENTS

Electric Submersible Solids Handling Pumps to be used to remove scum from a scum pit.

38.9	OPERATING CONDITIONS	N/A GPM @ N/A TDH
38.10	MINIMUM SHUTOFF HEAD	58 FT
38.11	MAXIMUM MOTOR HP	32 HP
38.12	MINIMUM HYDRAULIC EFF. (@ Design)	83.3 % @ BEP
38.13	MAXIMUM MOTOR RPM	1160 RPM
38.14	FULL LOAD AMPS	N/A
38.15	VOLTAGE	460 VOLTS 60 HZ
38.16	SOLID DIAMETER	3 IN
38.17	SUCTION SIZE : 8 INCH	
38.18	DISCHARGE SIZE: 8 INCH	
38.19	PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION	

38.20 POWER CABLE: Provide 50 ft of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

38.21 TEMPERATURE PROTECTION: Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer.

38.22 SEAL LEAK DETECTION: Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, on motors 80HP and larger provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

38.23 "PumpSafe" MOTOR SENSOR MONITORING RELAY: The pump supplier shall furnish all relays required for monitoring all motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt, and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.

38.24 Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "status OK"; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both "test" and "reset" pushbuttons.

38.25 An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 5 amps at 120 volt.

38.26 IMPELLER AND WEAR RINGS- SINGLE VANE OR MULTIVANE ENCLOSED TYPE:

Provide non-clog type impeller, capable of passing at minimum a 3" spherical solid. Statically and dynamically balance the impeller. On enclosed impeller designs, provide hard metal wear rings of material and Brinell hardness specified, to insure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (i.e. bronze, 304 or 316 stainless) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

38.27 SHAFT: Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. Machine the shaft of carbon steel (for maximum strength and motor efficiency) and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Do not use carbon steel as shaft material without a stainless steel sleeve. If a sleeve is not used, machine the entire pump/motor shaft of ASTM A276 Type 420 stainless steel.

38.28 SHAFT SEAL: Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

38.29 **BEARINGS:** Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings .If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump.

38.30 **MOTOR:** Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104° F (40° C) [optional: 140°F (60° C)]. Allowable maximum submergence shall not be less than 100ft (30 m). The motor stator shall be wound using Class H monomer-free polyester resin insulation resulting in an overall motor rating of 311 Degrees F (155 degrees C), Class F insulation. The stator windings shall be trickle impregnated resulting in a winding fill factor of at least 95%. The use of a multiple step “dip and bake” type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described in section above. Provide adequately rated motor with sufficient surface area for ambient only cooling suited for the intermittent mode of operation in wet well wastewater applications, submerged or partially submerged, without damage. Motors containing di-electric oils used for motor cooling and/or bearing lubrication or motors where the pumped media or externally provided fresh water is directed through the motor shell for cooling are not acceptable.

38.31 Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code

38.32 **GENERAL:** Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump manufacturer. For guide pipe systems the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to 5 degree misalignment from vertical, pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but MUST be supplied where needed to maintain perfect alignment for pipe guides. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well. Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 83% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

38.33 Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities.

38.34 Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow.

38.35 SUBMERSIBLE SEWAGE PUMPS

38.36 Pump Case: Cast Iron, ASTM A48, Class 35B

38.37 Motor Housing: Cast Iron, ASTM A48, Class 35B

38.38 Impeller: Cast Iron, ASTM A48, Class 35B

38.39 Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B

38.40 Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B

38.41 Pump/Motor Shaft: Carbon Steel, ASTM A576, Gr.1045 with replaceable ASTM A276 Type 420 shaft protection sleeve. (NOTE: If sleeve is not supplied, entire shaft is to be ASTM A276 Type 420 stainless steel)

38.42 Shaft Sleeve (if used): Stainless Steel, ASTM A276 Type 420

38.43 Wear Ring, case: Cast Iron, ASTM A48, minimum 200 Brinell

38.44 Wear Ring, impeller (enclosed impellers only): Stainless Steel, AISI329, 350 Brinell

38.45 O-Rings: Nitrile Rubber (NBR)

38.46 Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 316Ti.

38.47 Lower Seal Faces: Silicon Carbide/Silicon Carbide

38.48 Upper Seal Faces: Silicon Carbide stationary/Carbon rotating

38.49 Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 316 (cables shall be nylon coated)

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- 38.50 Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316
- 38.51 Oil-all uses (seal lubrication, etc): Ecologically safe, parifin or mineral base
- 38.52 Power/Control Cable Jacket: Chloroprene with non-wicking fillers

38.53 QUALITY ASSURANCE - REFERENCED STANDARDS:

- 38.53.1 American Iron & Steel Institute (AISI)
- 38.53.2 American Society for Testing and Materials (ASTM)
- 38.53.3 Factory Mutual (FM)
- 38.53.4 Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)
- 38.53.5 National Fire Protection Agency (NFPA)
- 38.53.6 National Electric Code(NEC)
- 38.53.7 National Electrical Manufacturers Association(NEMA)
- 38.53.8 Anti-Friction Bearing Manufacturers Association(AFBMA)
- 38.53.9 International Standards Organization (ISO) -

38.54 DELIVERY

38.54.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

38.54.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

38.54.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

38.54.4 Vendor shall be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

38.54.5 Final Delivery details should also be coordinated with Mr. Rosendo Morales, 7440 Cullen, Houston, Texas 77051 (Phone # 713-569-7357).

38.55 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

38.56 WARRANTY

38.56.1 The manufacturer shall furnish the following to the owner:

38.56.2 Shall provide one (1) year warranty from the date of final system acceptance.

38.57 MANUFACTURERS/VENDOR SERVICES

38.57.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

38.57.2 Provide complete training and local service capability for a period of not less than one half day.

38.57.3 Be present during installation and/or start-up of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and test and certify the system has been properly furnished and is ready for operation.

38.57.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

39.0 **LINE ITEM NO. 39 PUMP, HEAVY DUTY W/MOTOR**

Make: KSB

Model: No. K250-401/G-V or City Approved Equal

39.1 SUMMARY OF REQUIREMENT:

GREENRIDGE WWTP RAS PUMP

(Vertical Centrifugal Pump with flex coupled motor)

39.2 GENERAL DESCRIPTION

Pumps shall be capable of handling untreated wastewater containing solids up to 4" diameter. The pump shall be centrifugal, single stage, end suction / radial discharge type with centerline discharge. The pump shall be designed as "back pull-out" such that the entire rotating assembly can be removed without disturbing the suction and discharge connections.

39.3 PERFORMANCE REQUIREMENTS

39.4 Impeller Size - 13.5" Diameter

39.5 Minimum free solids passage: 4 Inch diameter

39.6 Minimum Shutoff head: 41 FT

39.7 Maximum Motor HP: 20 HP

39.8 Electrical supply to motor: 460 volt, 3 phase, 60 Hz.

39.9 Minimum Hydraulic Efficiency (at design): 75%

39.10 Maximum Pump/motor speed: 875 RPM

39.11 QUALITY ASSURANCE - REFERENCED STANDARDS:

39.12 American Iron & Steel Institute (AISI)

39.13 American Society for Testing and Materials (ASTM)

39.14 Hydraulic Institute Standards for Centrifugal, Rotary, and Reciprocating Pumps (HI)

39.15 National Electric Code (NEC)

39.16 International Standards Organization (ISO) - ISO9001

39.17 MATERIALS

39.18 Pump Case: Cast Iron, ASTM A48, Class 35B

39.19 Back plate: Cast Iron, ASTM A48, Class 35B

39.20 Impeller: Cast Iron, ASTM A48, Class 35B

39.21 Pump Shaft: Stainless Steel, ASTM A276 Type 420

39.22 Bearing Bracket: Cast Iron, ASTM A48, Class 35B

39.23 Wear Ring, case, enclosed impeller designs only: Duplex Stainless Steel, AISI 329

39.24 Gaskets and seal elastomers: NBR

39.25 Fasteners: Stainless Steel, ASTM A276 Type 300.

39.26 Outer Seal Faces: Silicon Carbide/Silicon Carbide

39.27 Inner Seal Faces: Silicon Carbide/Silicon Carbide

39.28 Seal lubrication oil: non-toxic mineral or parafin base oil

39.29 INSTALLATION CONFIGURATION

The pump shall be designed for installation in a vertical position, driven directly by a vertically mounted motor through a flexible coupling.

39.30 BEARING FRAME

The bearing frame shall be heavy cast iron construction, of minimum ASTM A48 Class 35 cast iron, accurately machined to ensure permanent bearing alignment. The pump side of the frame shall form the seal oil housing. Bearings shall be permanently lubricated or regreasable as needed to provide an L10 life of, at minimum, 100,000 hours at optimum design axial and radial shaft loads.

39.31 MOTOR FRAME AND COUPLING

The drive motor shall mount on a heavy stand with the lower end machined to fit the bearing frame. The pump/motor shaft coupling shall be a standard design flexible coupling. The motor frame shall include coupling guards which, when removed, provide easy access to the flexible coupling.

39.32 DRIVE MOTOR

The drive motor shall be NEMA B design, rated for continuous duty at 40°C, in a vertical mounted "TC" frame. The enclosure shall be [open drip-proof] [totally enclosed fan cooled]. The motor shall be mounted on the motor frame at the factory to check for proper operation and alignment, then removed for shipping. Following field installation and prior to startup the installing contractor shall reinstall the motor to the frame, properly install the flexible coupling and accurately realign the motor/coupling to pump manufacturer's specifications.

39.33 MAJOR COMPONENTS

Furnish major components (pump case, impeller, back plate, and bearing bracket) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities.

39.34 PROTECTIVE COATING

All pump components shall be cleaned to SSPC-SP10 (near white) and coated with a ferric oxide primer. Shop-applied surface finish shall be a 2-component epoxy resin base coating with a solids content >82%. Motors, couplings and other components not manufactured by the pump supplier shall be supplied with the component manufacturer's standard surface finish.

39.35 CLEAN-OUT PORT

All pumps with discharge size of 4" or larger shall include a minimum 4-5/8" diameter clean out aperture cast into the pump case near the cut-water. The clean out aperture cover shall be cast of the same material as the pump case and shall extend completely through the pump case with an inside contour to match the case. The cover shall fasten to a flange cast onto the pump case and shall be sealed with an o-ring. Fabricated (non-cast) cover plates, covers not contoured to match the casing, or covers with flat gasket seals will not be considered as acceptable.

39.36 WARRANTY

The pump manufacturer shall warrant the pump to the Owner against defects in workmanship and materials, covering parts replacement for a period of 12 months from date of installation not to exceed 18 months from date of shipment. Pump manufacturer's warranty shall be in published form, and shall apply to all similar units. A copy of the warranty shall be provided to the Owner at startup.

39.37 ACCEPTABLE MANUFACTURERS

All products, whether named as "acceptable" or proposed as "equal" must fully comply with these specifications. Standard product must be modified, if required, for compliance. Alternate proposals must include a clear statement of each point of difference between the proposed alternate product and these specifications. The Owner and Engineer reserve the right to reject any bid not based on specified product.

40.0 **LINE ITEM NO. 40 PUMP, HEAVY DUTY PUMP & MOTOR**

Make: Aurora

Model: No. 344ABF 2X2.5X9 or City Approved Equal

41.1 **SUMMARY OF REQUIREMENT:**

Requirements for providing NPW Booster Pump & Motor Assembly

41.2 **GENERAL**

The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

41.3 **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved direct replacement to the NPW Booster Pump & Motor Assembly as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

41.4 **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

41.5 **GENERAL SPECIFICATIONS:** Units described shall be new, unused and of the current year's production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The supplier shall be required to provide the booster pumps and all parts required for the NPW Booster Pump & Motor Assembly. The supplier shall include and match the current mount which is a horizontal frame mount. The booster pumps shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.

41.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

41.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

41.8

41.9	RATED DUTY	41.10	150 GPM @ 80' TDH @ 1750 RPM
41.11	PUMP TYPE	41.12	CENTRIFUGAL
41.13	PUMP SIZE	41.14	2X 2 1/2 X 9 INCHES
41.15	IMPELLER DIAMER	41.16	9"
41.17	SERVICE FACTOR	41.18	1.0
41.19	MOTOR DRIVE	41.20	10-HP, 460-VAC, 3-PHASE, 60-HZ

41.21 2.1.1 The output shall be 150 GPM @ 80' TDH @ 1750 RPM

41.22 2.1.2 Impeller diameter shall be 9"

41.23 2.1.3 The inlet and outlet size shall be 2" discharge and 2^{1/2}" suction flange connection

41.24 Pump shall have a volute type casing made of cast iron

41.25 Pump shaft shall be made of steel

41.26 MOTOR

- 41.27 Motor frame shall be rated at 1745 RPM
- 41.28 Motor shall be 10 HP
- 41.29 Motor shall be electric with a 1.0 service factor
- 41.30 Motor shall be totally enclosed fan cooled induction motor
- 41.31 Motor shall be horizontally mounted

41.32 DELIVERY

40.32.1 Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

40.32.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

40.32.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

40.32.4 Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

41.33 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

41.34 WARRANTY

40.34.1 The manufacturer shall furnish the following to the owner:

40.34.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

41.0 LINE ITEM NO. 41 PUMP, HEAVY DUTY PUMP & MOTORS

Make: Aurora

Model: No. 344ABF 4X5X12 or City Approved Equal

41.1 SUMMARY OF REQUIREMENT:

41.2 Requirements for providing NPW Pump & Motor Assembly

41.3 GENERAL

The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

41.4 **EQUIVALENT PRODUCT:** Bids will be accepted for consideration on any make and model that is a city approved direct replacement to the NPW Pump & Motor Assembly as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

41.5 **INTERPRETATIONS:** In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

41.6 **GENERAL SPECIFICATIONS:** Units described shall be new, unused and of the current year's production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The supplier shall be required to provide the pumps and all parts required for the NPW Pump & Motor Assembly. The supplier shall include and match the current mount which is a horizontal frame mount. The pumps shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.

41.7 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

41.8 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

41.9

41.10	RATED DUTY	41.11	770 GPM @ 128' TDH @ 1750 RPM
41.12	PUMP TYPE	41.13	CENTRIFUGAL
41.14	PUMP SIZE	41.15	4 X 5 X 12 INCHES
41.16	IMPELLER DIAMER	41.17	12"
41.18	SERVICE FACTOR	41.19	1.0
41.20	MOTOR DRIVE	41.21	50-HP, 460-VAC, 3-PHASE, 60-HZ

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- 41.22 The output shall be 770 GPM @ 1280' TDH @ 1750 RPM
- 41.23 Impeller diameter shall be 12"
- 41.24 The inlet and outlet size shall be 4" discharge and 5" suction flange connection
- 41.25 Pump shall have a volute type casing made of cast iron
- 41.26 Pump shaft shall be made of steel

41.27 MOTOR

- 41.28 Motor frame shall be rated at 1775 RPM
- 41.29 Motor shall be 50 HP
- 41.30 Motor shall be electric with a 1.0 service factor
- 41.31 Motor shall be totally enclosed fan cooled induction motor
- 41.32 Motor shall be horizontally mounted

41.33 DELIVERY

41.33.1 Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

41.33.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

41.33.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

41.33.4 Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

41.34 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

41.35 WARRANTY

41.35.1 The manufacturer shall furnish the following to the owner:

41.35.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

42.0 LINE ITEM NO. 42 PUMP, HEAVY DUTY PUMP & MOTOR ASSEMBLY

Make: Aurora

Model: No. 364ABF 2.5X3X12 or City Approved Equal

42.1 SUMMARY OF REQUIREMENT:

Requirements for providing Potable Water Pump & Motor Assembly

42.2 GENERAL

The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as “irregular” or “non-responsive”, any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder’s responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as “non-responsive”. All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

42.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement to the Potable Water Pump & Motor Assembly as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

42.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

42.5 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year’s production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The supplier shall be required to provide the pumps and all parts and modifications required for the Potable Water Pump & Motor Assembly. The supplier shall include and match the current mount which is a horizontal frame mount. The pumps shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.

42.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

42.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder’s proposal and will be provided without cost or obligation to the *City of Houston*.

42.8	RATED DUTY	300 GPM @ 117’ TDH @ 1760 RPM
42.9	PUMP TYPE	CENTRIFUGAL
42.10	PUMP SIZE	2 ½ X 3 X 12 INCHES
42.11	IMPELLER DIAMER	12”
42.12	SERVICE FACTOR	1.0
42.13	MOTOR DRIVE	20-HP, 460-VAC, 3-PHASE, 60-HZ

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- 42.14 The output shall be 300 GPM @ 117' TDH @ 1760 RPM
- 42.15 Impeller diameter shall be 12"
- 42.16 The inlet and outlet size shall be 2^{1/2}" discharge and 3" suction flange connection
- 42.17 Pump shall have a volute type casing made of cast iron
- 42.18 Pump shaft shall be made of steel

42.19 MOTOR

- 42.20 Motor frame shall be rated at 1775 RPM
- 42.21 Motor shall be 20 HP
- 42.22 Motor shall be electric with a 1.0 service factor
- 42.23 Motor shall be totally enclosed fan cooled induction motor
- 42.24 Motor shall be horizontally mounted

42.25 DELIVERY

42.25.1 Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

42.25.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

42.25.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

42.25.4 Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer, at 832-395-5459.

42.26 TOOLS AND SPARE PARTS

(4) Operations and Maintenance manuals.

42.27 WARRANTY

42.27.1 The manufacturer shall furnish the following to the owner:

42.27.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

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43.0 LINE ITEM NO. 43 PUMP, POLYMER FEED WITH MOTOR

Make: Moyno

Model: 2000 Series 2E012G1SSF3CAA or City Approved Substitute

43.1 SUMMARY OF REQUIREMENT:

43.1.1. Requirement for Polymer Feed Pumps, with Motors at Keegans Bayou WWTP.

43.1.2. GENERAL: The City of Houston intends to procure Polymer Feed Pumps for its Keegans bayou Wastewater Treatment Plant. The proposed new pumps are to replace the old Moyno Pump Model 2000 2E 012G1 SSF3AAA Polymer Feed Pumps currently installed at this location. However, equivalent pumps from other vendors could be acceptable. Therefore, prospective vendors are encouraged to visit the site to make sure that the pumps they offer will fit the existing location, with NO modifications to the existing structures and systems.

43.1.3. The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

43.1.4. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is equal to or superior the old Moyno Model 2000 2E012G1 SSF3AAA Polymer Feed Pumps currently installed at Keegans Bayou WWTP, as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation for each deviation or substitution.

43.1.5. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for clarification to the specifications shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum, in accordance with Local Public Contract Laws.

43.1.6. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein.

43.1.7. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sole judge of its adequacy to fulfill this requirement.

43.1.8. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCT/DESIGN REQUIREMENTS

43.2 The pump specified here will be used to pump polymer from the Batch Mixing System to the Belt Filter Presses.

43.3 Pump

43.3.1. Design Flow: 20 gpm @ 93 psi.

43.3.2. Suction and Discharge Size 4"

43.3.3. Pumps shall handle broad range of viscosities.

43.3.4. They shall be heavy duty, positive displacement, and progressing cavity type with a gear joint drive train.

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43.3.5. Rotor shall be machined from alloy steel (or 316 stainless steel).

43.4 Motor:

43.4.1. Shall be designed to deliver the above specified pump performance.

43.4.2. Shall comply with NEMA standard MG-1.

43.4.3. Shall have a combined service factor (combined effect of voltage, frequency) of minimum 1.15.

43.4.4. Shall have NEMA PREMIUM electrical efficiency or equivalent.

43.4.5. Shall have Voltage tolerance no less than 10% and no more than 5% from its voltage rating.

43.4.6. Shall be fully compatible to function as intended when connected to the existing switchgear and infrastructure.

PART THREE - EXECUTION

43.5 MANUFACTURERS/VENDOR SERVICES

43.5.1. The manufacturer shall furnish the services of a competent factory representative to do the following:

43.5.1.1. Inspect the system prior to delivery, supervise the City of Houston start up and testing of the system, and certify the system has been properly furnished and is ready for operation.

43.5.1.2. Instruct the owner's operating personnel in the proper operation and maintenance of the system for a period of not less than one half day.

43.5.1.3. Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

43.6 TOOLS AND SPARE PARTS

43.6.1. The manufacturer shall furnish the following to the owner:

43.6.1.1. Tools and spare parts for at least one year.

43.6.1.2. At least two copies of the the Operations and Maintenance Manual.

43.7 WARRANTY

43.7.1. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start up which ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

43.7.2. The vendor and/or the manufacturer shall allow the City the option to purchase an extended warranty.

43.8 DELIVERY

43.8.1. Entire assembled unit shall be delivered at COH's Cullen Service Center, 7440 Cullen Blvd, Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

43.8.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

43.8.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

43.8.4. Final Delivery details should also be coordinated with Mr. Gurdip Hyare, Managing Engineer, Plant Operations, Wastewater Operations Branch, 2525 S/Sgt. Macario Garcia, Houston, Texas 77020 (69th St WWTP, Phone # 832-395-5459).

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44.0 LINE ITEM NO. 44 PUMP, SLUDGE CAKE PUMP

Make: Moyno

Model: 2000 Series 4J115G4 or City Approved Substitute

44.1 SUMMARY OF REQUIREMENT:

44.2 Requirements for providing a Moyno cake pump

44.2.1. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

44.2.2. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is city approved as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

44.2.3. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

44.2.4. GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to the bid date.

44.2.5. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

44.2.6. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCTS

44.3 EQUIPMENT

44.3.1. Moyno progressive cavity pump 4J115G4 CDQ-X 3ARA, Four Stage: default (vertical).

44.3.2. Coupling, LS – Coupling; Low Speed

44.3.3. GRDCPL, LS – Coupling Guard; Low Speed; OSHA.

44.3.4. Design Flow; 48 GPM@ 200 PSI

44.3.5. Pump Speed: 46.45 RPM

44.3.6. Suction: 16" 125 LB. Flat Faced Flange

44.3.7. Discharge: 8" 300 LB Raised Faced Flange

44.3.8. Rotor: 4150 Alloy Steel with 0.10" hard chrome plate, Rc 57-60

44.3.9. Stator: Nitrile

44.3.10. Housing: Fabricated Steel

44.3.11. Bearings: Tapered Roller, Grease Lubricated

44.3.12. Shaft Steel: Braided & Split PTFE Packing with Graphite, Splite PTFE Lantern Ring

44.3.13. Packing Gland: Cast Iron, Split Type

44.3.14. Nameplate: Stainless Steel

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44.4 MOTOR

- 44.4.1. Type: Baldor AC Motor
- 44.4.2. HP: 20
- 44.4.3. Frame: 256TC
- 44.4.4. Phase/Cycle: 3/60
- 44.4.5. Voltage: 460
- 44.4.6. RPM: 1750
- 44.4.7. Duty: Continuous
- 44.4.8. Service Factor: 1.15 (1.0 on VFD Duty 10-60 HZ Constant Torque)
- 44.4.9. Insulation: Class H
- 44.4.10. Enclosure: TEFC
- 44.4.11. Assembly: F1
- 44.4.12. Thermal Protection: Thermostats
- 44.4.13. Other: Footless, Premium Efficient, Severe Duty, Inverter Duty, Canopy

44.5 GEAR REDUCER

- 44.5.1. Type: Eurodrive Right Angle Reducer
- 44.5.2. Model: K97AM256TC
- 44.5.3. Ratio: 30.82:1
- 44.5.4. Mounting Position: M4, Class 11
- 44.5.5. Other: Footmounted, Output Shaft A

44.6 BASE

- 44.6.1. Type: In-Line Carbon Steel Base

44.7 FLEXIBLE COUPLING

- 44.7.1. Brand: Falk
- 44.7.2. Model: 1100T10

44.8 GALVONIZED COUPLING GUARD

44.9 RUN DRY PROTECTION

- 44.9.1. Type: Stator Temperature Assembly
- 44.9.2. Controller: By Andritz
- 44.9.3. Thermocouple Head
- 44.9.4. Swage Nipple
- 44.9.5. Thermocouple Type T
- 44.9.6. Thermowell (factory installed in stator)

PART THREE - EXECUTION

44.10 DELIVERY

- 44.10.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen Houston TX, 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 44.10.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 44.10.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 44.10.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

44.11 TOOLS AND SPARE PARTS

- 44.11.1. (4) Operations and Maintenance manuals.

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44.12 WARRANTY

44.12.1. The manufacturer shall furnish the following to the owner:

44.12.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

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45.0 LINE ITEM NO. 45 PUMP, SLUDGE TRANSFER

Make: Moyno

Model: Z18KC11RMA/E412 or City Approved Substitute

45.1 SUMMARY OF REQUIREMENT:

45.1.1. This section is for heavy duty, positive displacement, progressing cavity pumps for the pumping of sludge or slurry in the Beltway Wastewater Treatment Facility. Pump shall be constructed with a split coupling design that allows full drive train including rotor, stator, shaft, rod, and seal to be removed with no electrical disconnection, and suction and discharge ports to remain connected to the pipe work. Pump shall provide 300 GPM @ 325 RPM maximum and 45 GPM @ 55RPM.

45.2 PUMP CASING AND SUCTION HOUSING

45.2.1. The bearing and suction housings of the pump shall be thick-walled cast iron. All cast parts shall be free of sand holes, blow holes, and other defects.

45.3 SUCTION AND DISCHARGE

45.3.1. The suction and discharge connections shall be 125 lb. or better flat face flanges with bolt whole dimensions and spacing to ANSI Standards.

45.4 ROTOR

45.4.1. The rotor shall be Hard Chrome Plated Tool Steel or better with a nominal chrome plate thickness of .010 inches for maximum abrasion resistance. The rotor shall be a machined and polished.

45.5 STATOR

45.5.1. The stator shall be constructed of Nitrile Rubber with double helix configuration and shall be vulcanized in a metal tube and have a shore hardness of 70. The stator seals shall be designed to prevent the material being pumped from contacting the stator bonding and tube.

45.6 BEARINGS

45.6.1. The bearings shall be sized to provide a minimum service life of 50,000 hours when operating at the rated capacity. The bearing housing shall be sealed with a double bearing seal on both sides of the cartridge housing, and the housing shall be so designed that it can be removed without dismantling the pump or suction piping.

45.7 GEAR JOINTS AND SHAFT ASSEMBLY

45.7.1. The gear joints shall be of the grease lubricated crowned gear type, totally enclosed and protected by a wire reinforced elastomeric seal. Mechanical components of the gear joints shall be designed to operate for a minimum of 10,000 hours at the manufacturer's published maximum speeds and pressures.

45.7.2. A rigid, splined connecting rod shall connect the gear joints of the drive shaft and eccentrically moving rotor. The connecting rod shall pass through the shaft seal area inside the hollow drive shaft quill so that no eccentric loads are imparted on the shaft seal area. The quill portion of the shaft shall be hard chrome plated.

45.7.3. The drive shaft shall be of one piece construction through the bearings and shaft seal area. This design shall permit disassembly of the universal joints without effecting the alignment of the shaft in the shaft sealing area.

45.7.4. The bearings shall be of the grease lubricated, tapered roller bearing type with diverging pressure angles for maximum shaft stability. Bearings shall be designed for a minimum B-10 life of 30,000 hours under maximum operating conditions and shall not require periodic re-lubrication. The bearings shall be protected from contaminants by means of a bearing cover plate bolted to the bearing housing.

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45.7.5. The pump shaft shall be manufactured of solid bar stock and shall be solid shaft design of chrome. The shaft shall also incorporate a plug-in arrangement allowing quick replacement of the rotating assembly through the gland area without disturbing the suction piping or pump driver. Disassembly shall be front-pull-out design, allowing rotor, both "U" joints, and shaft to be removed as one unit.

45.8 Seal

45.8.1. Pump shall be supplied with Type 2100 a compact, unitized, single spring, elastomer bellows mechanical seal capable of use in wastewater applications.

45.9 Drive

45.9.1. The pump shall be driven by 10HP, 460V, 3PH, 60HZ, 1750 RPM TEFC/ Integral VFD Gear motor.

45.10 Installation

45.10.1 Installation will be done by the C.O.H. Maintenance Group.

45.11 OPERATION & MAINTENANCE MANUALS, DRAWINGS, TRAINING, & FOLLOW-UP

45.11.1. The Manufacturer or Vendor to supply four copies of O & M Manuals.

45.11.2. Vendor to give training of required PM of Equipment, if needed

45.11.3. Vendor/Manufacturer to be available for questions or follow-ups of equipment training for the first three months of purchase.

45.12 WARRANTIES

45.12.1. The Manufacturer shall provide one 1 year warranty from the date of delivery

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46.0 LINE ITEM NO. 46 PUMP, REBUILD KIT FOR MOYNO PUMP

Make: Moyno

Model: AS4945806 or City Approved Substitute

46.1 SUMMARY OF REQUIREMENT:

46.1.1. Requirements for providing a Moyno pump rebuild kit

46.1.2. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

46.1.3. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

46.1.4. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

46.1.5. GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.

46.1.6. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

46.1.7. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

PART TWO - PRODUCTS

46.2 EQUIPMENT

46.2.1. Rebuild Kit for a 4J115G4 CDQ-X 3ARA Moyno progressive cavity pump.

46.2.2. Two stator gasket parts 065/115, ARM N-8092.

46.2.3. Stator gasket K-size, ARM N-8092.

46.2.4. Stator housing assembly, 115, RM100, TMPPRB/CHF

46.2.5. Rotor assembly, 4J115G4, ASYSIL.

46.2.6. Two gear joint seals, J-size, NITRILE.

46.2.7. O-Ring, -162, NITRILE.

46.2.8. Two inspection gasket plates, G-size, NIT

46.2.9. Two gear joint kit, 4220120000, 2000-J size

46.2.10. Packing set, PKGSET (6) "J", 0.75X4.5 SFT

46.2.11. Two lantern ring assemblies, FRM J, TEFLON

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46.3 DELIVERY

- 46.3.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen Houston TX, 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 46.3.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 46.3.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 46.3.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

46.4 TOOLS AND SPARE PARTS

- 46.4.1 (4) Operations and Maintenance manuals.

46.5 WARRANTY

- 46.5.1. The manufacturer shall furnish the following to the owner:
 - 46.5.2.** Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

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47.0 LINE ITEM NO. 47 PUMP, SUBMERSIBLE

Make: Myers

Model: 4RX20M6-43 or City Approved Substitute

47.1 SUMMARY OF REQUIREMENT:

- 47.1.1. Requirements for providing Myers 3 inch Sump pump model #4RX20M6-43 for 69th Street Sludge Plant
- 47.1.2. GENERAL: The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.
- 47.1.3. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make that is a direct replacement for a Myers submersible pump, model #4RX20M6-43. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.
- 47.1.4. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.
- 47.1.5. GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.
- 47.1.6. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.
- 47.1.7. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

47.2 DESIGN REQUIREMENTS

PUMP	SUBMERSIBLE PUMP
INLET	3 INCH
OUTLET	4 INCH DISCHARGE
MOTOR SPEED	1150 RPM
MOTOR(S)	2 HP, 3 PHASE, 230 V, 60 HZ

PART TWO - PRODUCTS

47.3 EQUIPMENT

- 47.3.1. Shall be a 3-inch submersible sump pump
- 47.3.2. Pump shall have 3-inch inlet and 4-inch discharge outlet
- 47.3.3. Motor shall be 2 hp, 3-phase, 230 V, 60 Hz.
- 47.3.4. Shall be a non-clog wastewater pump
- 47.3.5. Motor speed shall be 1150 RPM

47.4 DELIVERY

- 47.4.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.
- 47.4.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.
- 47.4.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.
- 47.4.4. Final delivery details should also be coordinated with Gurdip Hyare, Managing Engineer (Phone #832-395-5459)

47.5 TOOLS AND SPARE PARTS

- 47.5.1 (4) Operations and Maintenance manuals.

47.6 WARRANTY

- 47.6.1. The manufacturer shall furnish the following to the owner:
- 47.6.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**