NOTE TO CONSULTANTS: Edit with Track Changes turned on, any text in this section that appears in bold and italics then turn off the bold and italics for the final approved version. (Remove this Note).

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION:

A. Furnish and install a complete prefabricated pump station as shown on the drawings and described in the specifications.

1.02 SECTION INCLUDES:

A. Pipe, fittings, accessories and connections.

B. Control systems.

C. Pump Station and Accessories.

1.03 RELATED SECTIONS:

Section 26 00 00 - Electrical
Section 32 80 00 - Irrigation

1.04 REFERENCES:

A. NEMA - National Electrical Manufacturers Association

B. NEC - National Electrical Code

C. UL - Underwriters Laboratories, Inc.

1.05 SUBMITTALS: (Submit per the requirements of Division 1 Specifications).

A. Product Data: Provide component and control system and complete wiring schematic, including all pump components as specified. Provide manufacturer's literature including general pump assembly and pump curves showing performance characteristics with pump and system, operation point indicated, NPSH curve, controls, wiring diagrams and service connections and valves. Pump station manufacturer’s UL 508A and UL QCZJ file numbers.

B. Shop Drawings: Prior to construction, pump station manufacturer is to provide for approval, shop drawings showing location of proposed manifold, valves, control panels, discharge lines, and other support hardware. Pump manufacturer shall provide concept drawings and pump house requirements to assist contractor in pump house construction.

C. Pump Station Manufacturers Operation and Maintenance Manual: Include start-up instructions, detailed operation instructions, winterization procedures, as well as trouble shooting instructions.

1.06 QUALIFICATIONS:

A. Installer: The Contractor who will be purchasing and supervising the installation of the pump station shall be experienced in the installation of similar pump stations

B. Manufacturer: The Company specializing in performing the work of this section shall have a minimum of five years experience manufacturing packaged pumping stations. The entire pump station shall be manufactured, tested and labeled in the controlled environment in accordance with UL QCZJ requirements. No on-site fabrication or assembly shall be required or acceptable. Pump station manufacturer shall provide a list of at least 10 similar pump station installations, which use similar materials and equipment. Submitted examples must be constructed and must currently be operating for not less than one year.

B. Recommended Manufacturers include:

1. Precision Pumping Systems, Boise, ID
2. Flowtronex, Dallas, TX
3. Watertronics, Hartland, WI
4. Or, approved equal.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS:

A. Manufacturers:

1. Materials are as noted on the Drawings.

2. Substitutions: Submit per requirements of Division 1 Specifications.

B. Pump Station Piping: All fabricated piping shall conform to ASTM specifications A3 for Grade B welded or seamless pipe. Discharge piping shall provide burst pressure ratings of a minimum of six times the maximum operating pressure of the system. Piping shall be sized so that the average velocity does not exceed five feet per second and at no point exceeds ten feet per second. All welded fittings shall be seamless, conforming to ASTM Specification A234, with a pressure rating not less than 150 psi.

2.02 PUMPS:

A. General: See Drawings for pump specifications.

1. Pump(s) shall be capable of producing the maximum flow rate and total dynamic head shown in the bid item table. The pump station manufacturer shall calculate all losses within the pump station, and size the pump(s) to ensure that the specified flow and head conditions are met at the pump station discharge. The pump(s) shall have a service factor of 1.15, but shall not operate within the service factor at the specified design points.

2.03 PUMP STATION SUB-STRUCTURE:

A. Pump Station Sub-structure

1. The entire system shall be mounted on a single sub-structure. The sub-structure shall be steel, and shall be capable of supporting all of the material and equipment associated with the pump station. It shall also be capable of withstanding the rigors of hauling, offloading, installation, and day to day operation, as well as all maintenance and service. Tubing frames shall not be accepted. Supports for discharge piping shall be at a maximum of 4 feet on center. All components shall be mounted on this skid, in a professional workmanlike manner.

B. All bolts, washers, nuts and fasteners used in the assembly of the pumping system shall be zinc or cadmium-plated to retard corrosion.

C. The entire unit, with the exception of the pump, motor, valves, filters, electrical components, and control panels, shall be cleaned to bare steel and then coated with a baked on powder coating.

2.04 VALVES:

A. Check Valves:

1. Check valves shall be provided at the discharge of all pumps. A continuous acting air relief valve shall be installed on the upstream side of the check valve. The check valves shall be spring loaded non-slam type. The check valves shall be sized to allow full pump capacity with pressure loss not exceeding 2.5 psi. The check valves shall be silent check valves.

B. System Isolation Valves:

1. The prefabricated pump skid shall include an isolation valve for each pump. The isolation valves shall isolate the pumps in case the pump requires removal for service. The isolation valve for all pumps shall be wafer style butterfly valve, or equivalent.
2. System isolation valve shall be located on the discharge of the pump station to isolate the entire system. The system isolation valve shall be a wafer style butterfly valve, or equivalent.
3. Valves six inches and under may be lever operation, valves eight inches or larger shall be gear operation.

C. Drain Valves:

1. The pump station manifold shall include a drain valve, or valves, to ensure the complete drainage of the manifold.

D. Air Relief Valve:

1. The pump station shall include continuous acting air relief valves on the discharge manifold, as well as each main pump discharge. The air relief valve shall continuously discharge entrapped air in the system.

2.05 CONTROLS:

A. Gauges and Switches:

1. Gauges shall have a range at least as high as the shut-off head of the pump or pumps.

B. Low Intake Water Switch:

1. The pumping system shall be equipped with a safety switch to shut off the system if the water supply for the pump station is insufficient. The switch shall work in conjunction with the Programmable Logic Controller (PLC). In the event that the supply drops below a safe operating level, the PLC will shut down the pump system. The PLC shall be programmed to attempt to restart the pumping system two times. If after two attempts the water supply is too low, the system will require a manual reset.

C. Pressure Transducer:

1. The pressure transducer shall continually monitor system pressure. A 4-20ma signal shall be transmitted to the VFD and the VFD shall react according to pre-programmed criteria. The pressure transducer shall be stainless steel and shall be hermetically sealed.

D. Pump Control:

1. The pump control panel shall be listed per UL 508A. The control panel shall also be rated for the environment in which the system will operate.
2. The variable frequency drive pump control panel shall be manufactured as follows:
   a. The variable frequency drive shall be an ABB ACS series VFD rated for the FLA of the pump motor.
   b. The VFD shall include the pump and fan macro.
   c. The VFD shall be mounted in a NEMA 3R enclosure. The enclosure shall be dust tight. No outside air shall enter the enclosure during normal operation.

d. The pump control panel shall include a service entrance disconnect.
e. The control panel shall include complete motor starter circuits (manual motor protectors and contactors) for all pumps including the VFD pump.
f. The entire control panel, as well as individual devices shall be protected with circuit breakers. Fuses will not be accepted.
g. All pump controls and status displays including the touch screen HMI user interface, pump HOA selectors, pump and system status lamps and speed potentiometer shall be installed on the front door of the control panel enclosure.
h. The entire pump control panel shall be UL listed and rated for outdoor installation. All bidders shall include a UL file number with their bids.
i. Provide and install one pressure transducer.

3. The pump control panel shall be completely manufactured and tested prior to delivery to the job site. The VFD shall be installed by a factory trained and certified technician. The variable frequency drive shall be installed, programmed and started by a factory certified technician. The pump station supplier shall follow and document specific start-up procedures upon initial start-up of the system per manufacturer's criteria. All start-up documentation shall be signed by the supplier and the owner and submitted to the variable frequency drive manufacturer for their permanent file.

E. Operation:

1. The VFD shall operate the main pump at varying speeds to satisfy the programmed system pressure set point. As flow demand increases beyond the jockey pump's capability (if equipped), the variable frequency drive shall energize the main pump, and it shall operate at varying speeds to meet system pressure criteria. When demand increases beyond the main pump's capacity, the PLC will start a lag pump (if equipped), and the main pump will slow to accommodate the additional required flow. This process will continue, as demand increases, until all subsequent lag pumps (if equipped) are operational, and the system reaches maximum capacity. As flow demand decreases the system will operate in reverse order and eventually de-energize until flow demand again increases. All operations shall be controlled by a programmable logic controller (PLC). Operation and adjustment of the PLC settings shall be performed via touch-screen display on the front of the control panel.
2. The pressure sustaining jockey pump shall operate independently, and shall be controlled by a variable frequency drive. The VFD shall operate the jockey pump at varying speeds to satisfy the programmed system pressure set point. The jockey pump shall be sized to handle small watering applications as well as to enable the variable frequency drive to attain sleep mode at low flow and no flow conditions.

F. Variable Frequency Drive (VFD)

1. The VFD shall be operable in either AUTO or HAND mode. In AUTO mode, the VFD shall instantly react to the 4-20 mA signal from the pressure transducer. In HAND mode, pump speed shall be manually adjustable with a speed potentiometer. The VFD shall include an integral programmable logic controller which shall control all speed and switching operations in the pump station. Programs shall be stored in a non-volatile EPROM to ensure, in case of a power failure, that the program shall not be lost. The VFD shall be factory programmed with macros designed specifically for pumping applications. VFD functions shall be controlled with an integral digital key pad and alphanumeric display with two lines of twenty characters for status messages.

G. Programmable Logic Controller (PLC) and Human Machine Interface (HMI)

1. The pump control system shall include a programmable logic controller (PLC) for all switching and timing functions not performed by the VFD. The PLC shall also perform the following functions:

   - Programmed system start-up routine for initial start up
   - Variable start-up routines for power outages
   - Log motor run hours
   - Timing functions for lag pump and jockey pump
   - Automatically alternate pumps to equalize run time
   - Voltage monitoring and shutdown
   - Low water shutdown with automatic restarts
   - Low & High pressure shutdowns
   - Visual input / output indicators for troubleshooting
   - Future timing and control changes that may be required to fine tune the pump station

1. The Human Machine Interface (HMI) shall be a 5.7” touch-screen display unit with the following features and functions:
   - User adjustable real time clock display
   - One line, simple term declaration of current system status including any currently occurring faults
   - Reset button to restart the system after a system shutdown.
   - Fault log capable of storing up to 256 faults including initial fault time & date and recovery time
   - Real-time display of all system processes including pressure, flow, level and temperature
   - Display status for all pumps (stopped, running, faulted, idle) including speed for all VFD pumps
   - Display total pump run hours with reset button and date of last reset
   - Allow user adjustment of all settings relating to the operation and preprogrammed safety functions of the PLC

H. System Protection Features: The following safety circuits shall be included in the pump station.

1. Line Side Power Monitoring: The pump station shall be capable of monitoring incoming power and automatically disconnecting power if it does not meet specified criteria. The system shall be capable of monitoring high or low voltage, phase failure, phase unbalance and phase reversal. If specified criteria are not satisfied, a magnetic contractor shall be opened to prevent damage to the VFD.
2. Line Reactor or DC Choke: The station shall include a line reactor or DC choke sized to handle variations caused by regenerative current reversals inherent to heavy duty cycles required to drive applications and shall be rated at a minimum of 1.5% impedance at full load amps.
3. Lighting and Surge Protection: The pump station shall be equipped with lighting and surge arresters.
4. High Discharge Pressure: The pump station shall be equipped with a latching high pressure switch. If system pressure reaches a preset high level the entire system shall shut down and shall require manual reset.

PART 3 - EXECUTION

3.01 INSTALLERS:

A. Offloading and setting of pump station shall be arranged by the purchasing Contractor.

3.02 EXAMINATION:

A. The Contractor shall verify site conditions before beginning work.

B. Verify that required utilities (water and power) are available, in proper locations, and ready for use.

C. Beginning of installation means installer accepts existing conditions.

3.03 PREPARATION:

A. Review layout requirements with other affected work.

3.04 INSTALLATION:

A. Install pump, pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Pump Station

1. Install in accordance with manufacturer's instructions and only after shop drawings have been approved.
2. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

3.05 FIELD QUALITY CONTROL:

A. Field inspections and testing will be performed by the Engineer per requirements. The Contractor shall call the **SPR Inspection Request Line at (206) 684-7034 or by email at parksconstruction.inspection@seattle.gov** to make arrangements for inspections.

3.06 INSTALLER'S FIELD SERVICES:

A. Prepare and start systems per requirements. **(Note: No testing or operation of equipment using portable generators will be permitted)**.

B. Provide Pump system demonstration per requirements, as described in Section 33 80 00 - Irrigation.

C. Instruct Owner's personnel in the Operation and Maintenance of the pump station. Use O &M material as basis for demonstration.

3.07 PROJECT RECORD DOCUMENTS:

A. Submit per requirements.

B. The Contractor shall accurately record actual locations of all piping systems, valves, heads, conduit and any other deviations from the bid documents. Provide an accurate as-built plan of the finished pumping plant as required in Division 1 Specifications.

3.08 OPERATION AND MAINTENANCE DATA:

A. Submit per requirements of Division 1 Specifications.

B. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, including winterization and blowout, and manufacturer's parts catalog.

C. For pumps and accessories: Include trouble-shooting check lists, manufacturer's literature, cleaning procedures, replacement parts lists and repair data for pumps

D. Provide operation and maintenance instructions on all equipment.

3.09 WARRANTY:

A. The pump station manufacturer shall provide a minimum 2 Year Warranty for all materials and workmanship on the entire pump station. Warranty form is attached as follows:

IRRIGATION BOOSTER PUMP WARRANTY

(Project Name)

We hereby Warranty that the Irrigation Booster Pump System we have furnished and installed is free from defects in materials and workmanship and that the work has been completed in accordance with the drawings and specifications. Exceptions include acts of god and/or unusual abuse, or neglect by the Owner. We agree to repair or replace any defects in materials or workmanship, which may develop during the period of 2 years from date of Substantial Completion. We agree to correct any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Engineer, after receipt of written notice. In the event of our failure to make such repair or replacements within a reasonable time after receipt of written notice, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project Information

Project Name: _____

Project Location: _____

Consultant (System Designer): _____

Authorized Contractor Representative

Signed: _____Date_____

Title: _____

Effective Dates of Guarantee

Start Date (Substantial Completion): _____

End / Warranty Testing Date / Completion of Guarantee Period: _____

Approvals

Approved by: _____
(Project Manager)

Approved by: _____
(Construction Manager)

END OF SECTION