A.S. ALTUM & ASSOCIATES
AN IRRIGATION DESIGN & CONSULTING CORPORATION

PROJECT MANUAL

IRRIGATION PUMPING STATION SYSTEM

October 27, 2025

Prepared for:
City of Evansville
Fendrich Golf Course
1900 E. Diamond Ave.
Evansville, Indiana 47711

Prepared by:
A.S. Altum & Associates 32827
10311 Towne Road
Carmel, Indiana 46032
Office-(317) 876-3520
Cell-(317)-679-3285
Taltum@Asaltum.com

Specification for

Irrigation Prefabricated Pumping System

1.0 General

To provide a single source responsibility for the manufacture, warranty, service, and operation of a prefabricated, skid mounted, fully automatic pumping system for non-potable water. The pumping system shall automatically maintain a constant discharge pressure regardless of varying flow demands within the station rating. The pumping system shall conform to the following specifications in all respects. This specification covers minimum requirements; however, it should not be construed as all inclusive. It is the successful vendor's responsibility to include all necessary appurtenances to provide for a complete, automatic, smooth operating, and reliable pumping system. The manufacturer shall supply a complete set of general arrangement drawings, electrical power schematics, and control schematics in the operations & service manual.

1.01 Manufacturer

A. The pumping system shall be as manufactured by MCI Pumping Systems, Dallas, Texas, U.S.A., as basis of design. For consideration of a proposed alternate deduct system, the contractor shall furnish the following data to the engineer at least 5 days prior to the date of the bid opening:

1. A complete specification for the pumping system proposed as an equal.
2. A statement of full conformance to the following specifications signed by an officer of the manufacturer.
3. A general drawing showing overall dimensions and all piping layouts.
4. Complete submittal data for all components.
5. An electrical schematic showing power and control wiring and panel layout drawing.
6. Installation list of 200 similar pumping systems which have been in operation for a minimum of 3 years.
7. Location of closest factory owned or trained service centers.
8. Manufacturer's UL electrical industrial control panel file number UL508A and CSA-C22.2 No. 14.
9. Manufacturer's complete packaged pump system UL category QCZJ and QCZJ7 file number.
10. A copy of the manufacturer’s certificate of insurance showing as a minimum, a general liability coverage of $1,000,000, and an excess liability coverage of $10,000,000.

11. A complete list of all field service offices, complete with phone numbers and contact information, having the fields service office closest to the site clearly indicated.

12. ISO9001 Certification - 2015.

B. If, in the opinion of the engineer or consultant, the data submitted shows the pumping system to be an acceptable alternate deduct system, the bidding contractor shall be notified not less than 4 days prior to the bid opening date.

C. All bids shall be submitted using the MCI system as the basis of design. Alternate manufacturer's price, whose pumping system has been approved as an alternate deduct, shall be shown as an alternate on the bid form.

1.03 References

A. American Water Works Association (AWWA)

B. American National Standards (ANSI)

C. American Standards for Testing Materials (ASTM)

D. Hydraulic Institute

E. American Society of Mechanical Engineers (ASME)

1.04 Submittal Data Required

Within four weeks from the award of contract, provide three copies of the submittal for approval, properly dated, sectioned, bound, titled, with a table of contents, including no less than the following:

A. Full set of mechanical drawings including skid framing, connection dimensions, and equipment layout, all to scale

B. Full electrical schematic, including three-line power schematic, ladder logic, PLC (Programmable Logic Controller), and system interface.

C. Properly indicated pump curves which include pumping system internal losses, manufacturer's name (other than pumping system manufacturer), pump model number, and motor type, RPM, and horsepower

D. Properly marked cut sheets for each component of the pumping system, both mechanical and electrical

E. Copies of UL authorizations under categories and QCZJ/QCZJ7 and UL508A and CSA-C22.2 No. 14.

F. Complete description of the system including operation sequence, alarm sequence, receiving instructions, storage instructions and control feature description

G. Operation and Maintenance Manuals shall be submitted at the time when the pumping system is shipped to the site by the manufacturer. A manual shall have been prepared for this specific project and shall not be a general manual applicable to many systems. The manual shall bear the same format as the submittal and shall contain full submittal information. In addition, technical manuals shall be included for each piece of equipment that is field serviceable.

1.05 Sequence of Operation (PLC)

A. General Items applying to each alarm circuit shall include a display of condition on the system display, the illumination of a red indicating light, and manual reset of a persistent condition.

B. Alarm sequence

1. Low Discharge Pressure alarm circuit shall stop pumping system in the event discharge pressure drops below normal level. Operator interface device, mounted in enclosure door, shall signal low discharge pressure. The pumping system shall not operate until safety has been manually reset.

2. High Discharge Pressure alarm circuit shall shut down pumping system if discharge pressure reaches a predetermined high level. Operator interface device, mounted in enclosure door, shall signal high discharge pressure. The pumping system shall not operate until pressure is reduced, and the alarm has been reset.

3. Main phase failure and low voltage safety circuit shall retire the pumping system if it experiences low voltage, phase failure or phase reversal as monitored at line-side of control enclosure. Phase monitor shall have a time delay to allow for transient low voltage during motor starting and to allow maximum motor protection. Operator interface device, mounted in enclosure door, shall signal phase failure for any affected pump.

4. Individual Phase Failure and Low Voltage alarm circuitry, as part of the overload relay circuit, shall retire any pump that experiences low voltage, phase failure or phase unbalance as monitored at the load-side of each pump motor contactor by the overload relay. Each pump motor shall have its individual protective device and time delay to allow for transient low voltage during motor starting to allow maximum motor protection. The individual pumps or pumping system shall not operate until the voltage problem has been corrected and safety has been manually reset. Incoming phase monitor safety circuit as the only phase failure sensing device is not acceptable.

5. Loss of Prime alarm circuit shall protect the pumps from the adverse effects of running dry and cavitation. Alarm shall be activated when the level in inlet manifold drops below a critical low level. Alarm shall cause the pumps to be retired in an orderly manner. Alarm shall not be capable of being overridden. Alarm shall not allow any pumps to run until the level has been restored and the alarm has been reset. An indication of the alarm shall be displayed visually on the control panel door.

7. A High Pump Temperature alarm shall protect all individual surface pumps from system conditions which could cause the pump to overheat. If the temperature of the pump exceeds the maximum allowable temperature that is set an alarm shall cause the individual pump to be retired in an orderly manner. Alarm shall not be capable of being overridden. Alarm shall not allow any individual pump to run until temperature has been restored and alarm has been reset. An indication of the alarm shall be displayed visually on the control panel door.

C. Functional Sequence, Pressure and Flow Sequencing.

1. Initially the pressure sustaining pump shall operate XL to maintain system pressure during low demand periods.

2. If system pressure continues to drop, the Lead irrigation pump shall start.

3. PLC shall control the speed of the pump to produce constant pressure regardless of demand within the pump's capacity.

4. Lag pump/s shall start as required if system pressure continues to remain below setpoint after a short time delay (Adjustable).

5. PLC shall control the speed of the VFD-controlled pump(s) to produce constant pressure regardless of demand within the pump's combined capacity.

6. On failure of either lead or lag pump/s to start or to continue running, the next pump in sequence shall start in its place. Alarm light shall be illuminated, and individual pump fault shall be displayed.

7. Equal sized pumps shall be alternated based on accumulated motor run time after the running pump is retired. The pump with the least amount of time run shall be started first.

8. All data accessible on control panel HMI (Human Machine Interface) shall also be available remotely.

1.06 Codes

A. Without exception, the pumping system shall be UL listed as finally assembled under UL category QCZJ/QCZJ7.

B. Control panel with controls shall be built in accordance with NEC (National Electrical Code), and U.L. standards. Without exception, the electrical components and enclosure shall be labeled as a complete U.L. listed industrial control panel assembly, with manufacturer's U.L. label applied to the door, under UL category UL508A, control panels.

2.0 Pumps and Motors

2.01 Quality Assurance

A. 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.

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

C. 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 a program.

D. Pump(s) are to be engineered and manufactured under the certification of IS0-9001:2015.

2.02 End-Suction Pumps

A. The pump(s) shall be the product of Cornell.

The end-suction pump(s) shall be precision engineered, have hydraulic load balancing, a cast iron double volute with a suction spitter to provide increased efficiency and lifespan.

B. They shall be built with noise and vibration reduced, dynamically balanced, fully machined, bronze impeller with SEA 660 bronze replaceable wear rings.

C. The high-strength shafting shall be constructed from carbon steel.

D. They shall be equipped with a wear resistant mechanical seal for drip-proof sealing.

E. Premium efficient, NEMA standard, open drip-proof (ODP) motors wired for motor space heaters. Motors shall be the product of Baldor or WEG and have a service factor of 1.15 Sine. The frame shall be constructed from steel and the motor shall have a rigid base indicator. The motor shall have class F insulation, be inverter ready, and must include a rodent screen.

2.03 Performance

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

OPERATION CRITERIA

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Maximum Solids Passage	Max. Shutoff Head
System Design Condition	600 GPM	298’	3600 RPM	0.5”	362’

B. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head
and vertical static head from the minimum water level to the centerline of the pump discharge.

C. Maximum pump speed shall not exceed 3600 RPM.

D. Driver size shall be limited to 75HP maximum.

E. Liquid pumped is reuse water with a maximum temperature of 80deg.

2.04 Pressure Sustaining Pump

A. Manufacturers

1. Pump(s) shall be the product of Grundfos.
2. Manufacturer shall have installations of like or similar application with a minimum of 5 years' service for this pump size.

B. Design

The pump will rotate counterclockwise rotation when viewed from the driver end looking at the pump. They shall consist of a base and a pump head. Stay bolts secure the chamber stack and sleeve between the pump head and base. The base has inlet and outlet ports on the same level (in-line). All pumps are fitted with a maintenance-free cartridge type mechanical shaft seal.

C. Impeller

The impeller shall be constructed from AISI 304 stainless steel. Impellers manufactured of Stainless Steel with metallurgical qualities less than that of 304SS shall not be allowed.

D. Pump Sleeve

Sleeve shall be manufactured of AISI 304SS. The sleeve shall be designed to channel water flow adequately and efficiently through the various stages of the pump.

E. Pump Head

A pump head shall provide a structurally stable base to support the entirety of the pump while in operation. The head shall be constructed from ASTM 25B grey cast iron or ASTM A536 65-45-12 ductile cast iron and provide two inline flanges for connection to the piping system.

2.05 Motor Space Heater

The pumping system manufacturer shall provide on each pump motor a 120-volt, single phase space heater of ample size to prevent condensation from occurring within the motor during non-operating periods. The space heater shall be de-energized when the motor is running.

3.00 VALVES

3.01 Pump Isolation Valves

Pump isolation valves shall be of the butterfly type with grooved ends to provide for expansion and vibration dampening. **Lug style isolation valves are not acceptable**. The valve shall be complete with a spherical bore design to provide a leak tight stem seal regardless of disc position. Stem sealing force shall be constant throughout the full disc cycle. Design shall provide a bubble tight seal from full vacuum to 300psi when the valve is closed. The stem shall be provided with a secondary seal to provide a lifetime lubrication chamber. The Valve body shall be one-piece casting with an integral mounting base for gear operator or handle actuation. Valve shall be designed to meet or exceed the requirements of MSS SP-67. They shall be sized as shown in the pump schedule. The Valve body shall be constructed of ASTM A351 Grade CF8M stainless steel. The Valve disc shall be ASTM A351 Grade CF8M stainless steel, with no exception. Valve stem shall be constructed of ASTM A564 17-4PH stainless steel. The valve shall be NSF certified in accordance with ANSI/NSF 61 for cold +73°F/+23°C and hot +180°F/+82°C potable water service and ANSI/NSF 372. The isolation valve shall be manufactured by Victaulic.

Electrically actuated butterfly valves shall not be acceptable.

3.02 Pump Check Valve

Pump check valves shall be provided on the discharge of each pump and sized per the pump schedule. Check valves shall be of the silent type. Check valves shall begin to close as forward velocity diminishes and shall be fully closed at zero velocity preventing flow reversal. Valve bodies

shall be cast from Ductile Iron and shall be coated internally and externally with NSF/ANSI 61 certified fusion bonded epoxy. The valve design shall incorporate a center guided, spring loaded poppet, guided at opposite ends, and having a short linear stroke that generates a flow area equal to the pipe diameter. The valve spring shall be of a specially designed heavy-duty construction and stiffness to prevent slamming and chattering. Internals such as disc, and seat shall be machined 316SS. Disc shall incorporate an EPDM insert to provide resilient sealing. **Dual disc style or swing check valves shall not be accepted.** Valves shall be sized to permit full pump capacity to discharge through them without exceeding a pressure drop of 3 PSI. Check valves through 8" shall be model 888VFD rated at 400 psi working pressure as manufactured by Flomatic or approved equal.

3.03 Station Isolation Valve

Station isolation valve shall be installed on the suction and/or discharge of the pumping system to completely isolate the pumping system from the distribution system. The valve shall be of the lug style butterfly type. The valve must feature a single-piece body constructed from ductile iron. The stem shall be made from 416 stainless steel. The disc shall be made from 316 stainless steel. The stem shall be of one-piece design and fastened to disc via a double "D" design to prevent leak paths of any kind from reaching the stem. The stem shall not be exposed to the process fluid in any way to prevent premature failure. The seat shall be an EPDM elastomer, one piece construction, and shall also form the flange sealing gaskets. Valves 6" and smaller shall have a lever operator. Valves 8" and larger shall have a gear operator with a hand wheel. Valve shall be rated at 250 PSI bubble shutoff. Station isolation valve shall be manufactured by Bray or equal.

3.04 Pressure Relief Valve

A. Pressure relief valve shall be single-seated, diaphragm operated, pilot-controlled, globe or angle valve. It shall be spring loaded & hydraulically operated. The valve spring shall be stainless steel. The seat ring shall be stainless steel & readily replaceable with no special tools.

B. Diaphragm assembly shall be fully guided, top, and bottom. The diaphragm shall be of nylon reinforced Buna-N synthetic rubber and shall be fully supported by the valve casting in both the full-open and full-closed positions to eliminate strain on the diaphragm. All necessary repairs shall be possible without removing the valve from the line. Packing glands are not permitted. The disc shall be synthetic rubber (Buna-N) and have a rectangular cross section. Valve disc and seat shall have an anti-cavitation design of intermeshing orifices to prevent cavitation from discharge pressure to atmosphere.

C. The main valve shall be equipped with the following accessories to ensure proper operation.

1. All control valve pilots shall have stainless steel seats, a Buna-N sealing surface and a Buna-N diaphragm. Pilot valve bodies shall be made from bronze.

2. Pressure-sustaining pilot shall be sensitive to valve inlet pressure. Pilot shall be normally closed and spring-loaded with spring tension adjustment. Pilot shall open automatically against the spring-loading when pilot inlet pressure exceeds the set value. This pilot shall function to maintain a minimum valve inlet pressure which shall prevent the pumps from operating under an unstable or overloaded condition.

3. Isolation cocks shall be provided on control tubing at the valve inlet, outlet, and bonnet ports on valves 4" and larger. These valves shall be situated such that the control valve may be manually closed & the valve trim isolated and serviced.

4. Strainers shall be provided to remove any solids that may be of sufficient size to damage or plug the pilots and other control components. The inner mesh shall be of MONEL and shall be designed to support the outer screen. The outer screen shall be of 0.008" MONEL wire, having 40 x 40 mesh.

D. Isolation valves shall be provided conforming to the requirements of the high-pressure butterfly pump isolation valves specification.

E. Valve shall be a model 50A-01B manufactured by Cla-Val Company of Newport Beach, CA.

4.00 SKID AND PIPING

4.01 Skid

The pumping system shall be a completely skid mounted pumping package built by a single manufacturer. All equipment including, but not limited to, pumps, motors, valves, instrumentation, and controls, shall be mounted on a common structural steel base to form a complete operating pumping system unless otherwise dictated by site restraints. The pumping system base shall be designed and fabricated to provide proper structural support for all attached equipment. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, offloading, installation, and operation. All structural members shall be constructed from heavy weight structural tubing, channel, or I-beam. Provisions shall be made on the station base for off-loading and handling the station at the site of installation. Base shall include deck plate over all the skid, and structural steel plate mounted under pumps and motors. All deck and structural plate shall be 100% seal welded to peripheral structural members, and skip welded on the bottom to internal structural members. Skip welding of above plates is not permitted. Bent-form bases shall not be permitted on systems beyond 60” in length and 48” in width.

4.02 Fusion Bonded FDA Lined Piping

All piping shall be constructed from ASTM A105 schedule 40 pipes or heavier as required to maintain a 3 to 1 pressure safety factor. **(Sch10 piping shall not be allowed)** All steel piping shall be blasted internally, to SSPC-SP10 and lined with FDA/NSF61 approved fusion bonded epoxy. Epoxy shall be applied according to the manufacturer’s requirements, thickness shall be tested throughout and found to be without holidays. After fabrication and before coating, piping shall be hydrostatically tested to 150% of maximum shutoff pressure. **Proposed alternate systems utilizing non-internally coated piping or coated piping less than standard weight or Sch40 shall not be allowed.**

4.03 Coatings

Structural steel and supports shall be shot and grit-blasted with #80 cast steel shot and grit per SSPC-SP6 to a Commercial Blast Profile. The cleaned steel surfaces shall immediately thereafter be primed with a Zinc Epoxy powder coat. The finish coat shall be electrostatically applied super durable polyester TGIC to provide a combined coating thickness of no less than 3.8 mils and cured in a 450 degrees F oven. The test method for this coating shall verify conformity to ASTM D-3359 of a 100% 5B pass adhesion rating. Impact resistance of the primer shall be 160 in-lbs., and the finish coat shall be 80 in-lbs. per standard ASTM D-2794. The coating shall pass a 2000-hour salt spray test per ASTM B117 and Humidity resistance test per ASTM D610 of 1000 hours with no blistering. Hot-dip galvanization shall not be acceptable for skid and pipe coating.

4.04 Piping Support

All piping supports shall cover 120 degrees of arc under the piping and support the weight of the piping and the water it contains. Thrust shall be resisted by proper thrust blocking of the supply and distribution system piping which shall be connected to the pumping system in the field, and through proper anchoring of the pump station to the slab according to manufacturer's recommendations. **Piping supports not occupying at least 120 degrees of arc shall not be accepted.**

4.04 Transition Piping

Station discharge transition piping shall be constructed from ASTM A105 schedule 40 pipes or heavier as required to maintain a 3 to 1 pressure safety factor (including 1/16" corrosion allowance). Transition piping shall be designed for 90 degrees turn down and shall be equipped with a rigid coupling to facilitate alignment variances in the field. The pipe shall be equipped with thread-o-lets for customers' use. Transition pipe and thread-o-lets shall be as called out in the pump station technical specifications. All thread-o-lets shall be of 316 stainless steel construction.

5.00 Instrumentation

5.01 Pressure Gauge

A pressure gauge shall be mounted on each header, complete with isolation ball valves. All gauges shall be silicone oil filled to reduce wear due to vibration. Accuracy shall be within 1.5%. The gauge diameter shall be 3.5" minimum. Range shall be at least 30% higher than the highest pressure attainable from the pumps at shutoff head conditions and shall include 316SS internals. The pressure gauge shall be manufactured by Durachoice.

5.02 Pressure Transducer

Pressure transducer shall be mounted on the discharge headers and shall provide all pressure signals for the control logic. Pressure transducer shall be a solid-state bonded strain gage type with a characteristics deviation of plus/minus 0.25% (BFSL) and constructed of 316L stainless steel. Resolution of the transducer shall be greater than the resolution of the analog to digital conversion for PLC operation. Transducer shall be rated for pressures greater than station discharge pressure, and shall provide gauge pressure output, rather than absolute pressure.

5.03 Magnetic Flowmeter

This section describes the requirements for an electromagnetic flow meter and microprocessor-based signal converter. Under this item, the pump station manufacturer shall furnish and install the magmeter equipment and accessories as indicated on the plans and as herein specified. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter.

The sensor flow tube and liner material shall be constructed of a composite elastomer (PTFE or Hard Rubber) surrounded by two integral coils. Measurement and grounding electrodes shall be made of 316 stainless steel. Connecting flanges shall be carbon steel. *(12" – 48") The sensor flow tube shall be stainless steel surrounded by two coils. The liner material shall be PFA.* Installation: A minimum of 5 pipe diameters upstream and 3 pipe diameters downstream are recommended.

A. Operating Ambient Temperature Range: -4 to +140° F.

B. Enclosure: NEMA 4X enclosure

C. Display: Background illumination with alphanumeric 4-line, 20-character display to indicate flow rate, totalized values, settings, and faults

D. Power supply: 115/230 VAC or 11-24VDC.

E. Outputs: 4-20 mA into 800 ohms max. Output for external display of flow rate or totalizer.

F. Communications: Ethernet IP

G. Sensor and signal converter performance:

H. Maximal Accuracy Flow Range: 2 fps to 32 fps.

I. Minimum Accuracy: 0.5% of actual flow.

J. Separation: Not to exceed 900 feet between signal converter and sensor without the use of any additional equipment.

K. Bi-directional flow capabilities shall be standard.

L. Totalizer: Two eight-digit counters for forward, net, or reverse flow

M. The electromagnetic flow meter shall be an Endress Hauser Model PROMAG W300 flow sensor. Insertion type flow meters will not be accepted.

N. Zero diameters of slow spool upstream or downstream of the electromagnetic flow meter shall be required to achieve minimum accuracy of flow meter.

O. The electromagnetic flow meter must be connected to a cellular network and allow for remote parameter adjustment.

Signal Converter Function Details

The following functions shall be provided:

A. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.
B. The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.

C. The signal converter shall provide a 4-20 mA DC (Direct Current) signal proportional to flow rate into 800 ohms max. Output selectable as unidirectional or bi-directional.

D. The relay shall be programmable as error indicator, limit alarm or pulsed output.

E. The signal converter system shall be equipped with an error and status log with 4 groups of information.
    1. Information without a functional error involved.
    2. Warnings which may cause malfunction in the application.
    3. Permanent errors, which may cause malfunction in the application.
    4. Fatal error, which is essential for the operation of the flowmeter.

F. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.

G. Up to 5 currently pending diagnostic events can be displayed in the Diagnostic list submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

5.06 Heavy Duty Vacuum Reprime System

A heavy-duty vacuum reprime system shall be designed for the most challenging inlet lift applications. It shall include a Manual/Off/Auto control switch. The system shall have a 1" self-regulating air release valve and must be provided with a vacuum tank as part of the assembly for dynamic priming control. The system shall be equipped with a vacuum monitoring system and a high tank water level lockout. The system shall also include an automatic high flow vacuum pump for consistent priming, operating on a 120 VAC power supply. It shall also provide remote monitoring of real time vacuum pressure.

8.00 Hardware

All bolts, nuts, washers, and lock washers used in the assembly of the pumping system shall be zinc plated to retard corrosion

9.00 Control and Power

9.01 Scope: Furnish UL Listed 508a complete control panel that will provide the necessary controls to efficiently control the irrigation pumping system. The system shall be comprised of the components described in this section and specified in the technical datasheet. The system will provide all the required components including but not limited to main disconnect, surge protection, phase monitor, fuses/blocks, variable speed drive, high speed drive fuse protection, dual interlocked contactors, solid state overloads, door devices, color HMI touch screen and PLC.

9.02 Control system shall be a standard product with a configurable program. The system shall not use a custom program or one that requires modification to provide the specified system control. The HMI must use a manufacturer's standard offering without requiring screen or database changes.

Supply power is as called out on the technical datasheet.

Ratings/Listings

A. All products shall be UL labeled and meet the requirements of UL508a and maintain cUL.
B. 100 ka Short Circuit Current Rating of the panel
C. Service Entrance Rated
D. Manufactured by an ISO9001:2015 facility.

Environmental requirements

A. Temperature 14 to 122 Deg F.
B. Relative Humidity 98% maximum

9.03 Construction

Enclosure shall be a UL Listed Type 4 Carbon Steel enclosure with a powder coat finish. All penetrations in the panel shall be made prior to the application of the powder coat finish. The powder coat finish shall be a polyester Textured RAL 7035 heat guard finish. The powder coat process shall be a minimum of 5 stage process. The enclosure shall contain a pour in place two-part urethane gasket. **Adhesive strip gaskets shall not be allowed**. The enclosure door shall use a 3 Point latch system. If it is not mounted on the skid, the enclosure will be furnished with a 6" leg kit.

The enclosure and control panel must be manufactured at the same facility that the pump station is manufactured at.

9.04 Surge Arrestor

Surge Arrestor shall be UL1449 Type 1 listed and utilize multi-MOV technology. The surge arrestor shall have 76kA surge current rating per module, an SCCR of 200 kA, come with a visual fault indicator, and have remote, replaceable modules.

9.05 Main Service Disconnect

Main service disconnect shall be a rotary fusible disconnect with J Class fuses. The handle shall be padlock-able and interlock with the main panel door to prevent opening the door without first turning the disconnect to the off position. See through covers shall be provided to cover line and load side lug connections.

9.06 Phase Monitor

Phase monitor shall be an 8 Pin replaceable type unit with line side fuse protection. The phase monitor shall provide protection from low/high voltage, phase loss, reverse phase, and voltage unbalance. Unit shall be provided with diagnostic LED with adjustable trip delays.

9.07 Short Circuit protection

Control Panel shall be protected by J Type fuses. Motors wired for crossline power shall be protected by J Type fuses. Fuse blocks shall be finger safe and provided with covers. High clarity see-through covers allow for inspecting wire terminations or to take thermography measurements without removing the cover. Probe holes included for easy, safer testing and troubleshooting. The built-in lockout/tag out feature improves safety. VSD shall be protected by high-speed J type fuses such as the Bussman DFJ.

The panel will require a set of mechanically interlocked contactors with one solid state overload per pump. Contractors shall be Allen Bradley C series contactors. Coils shall be 110 Vac control and include varistor protection. Solid state overload shall be E1 Plus as manufactured by Allen-Bradley. Overload shall provide phase loss protection, ambience compensation and wide current adjustment range of 5:1.

9.08 Variable Speed Drive

Each variable speed drive shall be adequately sized to transmit the proper amount of current based on the pump motor requirements. Main pumps shall share a VFD, while jockey pumps shall have their own, dedicated VFD.

Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.

The VFD shall be a six-pulse input design. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform and shall output a waveform that closely approximates a sine wave.

The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or de-rating.

VFD shall automatically boost power factor at lower speeds. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

Switching of the input power to the VFD shall be possible without interlocking or damage to the VFD at a minimum interval of 2 minutes. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocking.

The VFD shall include an integral RFI filter conforming to the A2 standard as a minimum. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.5 msec. Printed Circuit boards shall be conformally coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC (International Electrotechnical Commission) 61721-3-3, Class 3C2. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

VFD shall include current sensors to monitor all three-output phases to detect and report phase loss or unbalance or other power issues to the motor. The VFD will identify which of the output phases is low or lost.

VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

All VFD's shall be of the same series and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

A battery back-up shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.

The VFD shall have an adjustable output switching frequency.

Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.

In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up. ***The pump station manufacture shall identify and record the 1st and 2nd critical frequencies on any pump operating on a VFD and shall lock out these frequencies. The pump/s may pass through these frequencies on ramp-up and ramp-down but shall not be allowed to reside within these identified frequencies.***

In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.

A Dual Ramp feature shall include a Check Valve Ramp and a final Ramp feature. The Check Valve Ramp shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.

The ambient operating temperature of the VFD shall be -10ºC to 50ºC (14 to 122°F), with a 24-hour average not to exceed 45ºC. Elevation to 3,300 feet (1000 meters) without de-rating. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -15% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.

The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. ModBus communications shall be integrally mounted.

VFD Keypad shall be mounted and accessible from the exterior of the control panel door in a NEMA 4 configuration. Keypads mounted internally shall not be allowed.

The utilization of an electrically actuated valve as a variable speed drive backup device shall be permitted by other manufacturers providing only that the unit is a valve providing linear proportional control and surge protection. Valve shall be either ball valve or eccentric plug valve. ***Non-Linear lug or wafer butterfly valves shall not be allowed as the design does not provide for efficient proportional and linear control nor provide surge protection****. Actuator shall provide modulating service utilizing PID loop. The actuator shall be a totally enclosed and sealed worm gear actuator and position indicator with externally adjustable open/close stops. The worm gear segment shall be ASTM A536 grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm. All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lbs. on the handwheel and an input torque of 300 ft-lbs. for nuts.*

9.09 Control Power Transformer

The control power transformer shall be a minimum of 350 VA and include primary and secondary fuse protection.

9.10 Programmable Logic Controller

The programmable logic controller shall be an Allen Bradley 5069 CompactLogix processor with built in dual port Ethernet and one USB port. The processor utilizing battery for program storage will not be acceptable. The unit shall operate on 24 Vdc and shall include 2 MB user memory. The operating range of the processor shall be 32 to 140 degrees Fahrenheit. PLC shall be provided with the capability of using an SD memory card for data logging. I/O shall be 24 VDC. The processor shall be capable of expanding the I/O with the addition of up to 4 expansion modules. The processor shall be provided with the following on board I/O:

A. 16 DC Inputs
B. 16 DC Outputs
C. 8 Analog Inputs current and voltage
D. 4 analog Outputs current and voltage

9.11 Color Touchscreen

HMI Color Touch Screen interface shall be an Allen Bradley Panel View Plus 6 10" HMI and shall Include 512MB memory, and Windows® CE 6.0 operating system. Recipe management, machine setup, and data-tracking through .csv files. HMI shall include:

A. Built-in PDF viewer for context-sensitive operator support.
B. Built-in full Unicode font to support multiple languages with a single run-time application.
C. Base-configured terminal available with display and logic modules.
D. Supports real-time monitoring of your terminals through a web browser.
E. RS-232 and Ethernet networks available through built-in communication ports.
F. Built-in USB ports and SD card slot
G. Allen Bradley 24 DC Power Supply: 5 Amp DC power supply with built in status indicators.
H. Allen Bradley 5 Port Ethernet Switch with 24 Vdc supply power.
I. Panel devices shall be Allen Bradley NEMA 4 30 mm heavy duty devices. Panel indicator lamps shall be 24 VDC LED types.
J. Level sensing relays shall be Crozet PNR utilizing 3W2 SS probe tips.
K. HMI shall contain job specific drawings and data which shall be user accessible within PDF format.

9.12 Control System Configuration

The control system configuration and operation parameters shall be configurable though the HMI touch screen and shall be available remotely. No laptops or programming devices shall be required to configure the system for operation. The system configurable parameters are protected by password levels to ensure correct personnel are making system configuration changes. Manufacture shall be capable of remote access to the actual PLC and HMI programs for upgrades and modifications. The following are parameters that are required but not limited to be configurable though the touch screen.

A. File Set up System; Allow changes to be saved to a SD memory card. Existing parameters may be uploaded from the SD memory card. This shall allow the system to be returned to the last state, factory default or new configuration.
B. Pump System: The quantity, type and operational parameters are assignable through the touch screen.

C. Pump Control Assignable safeties, lockouts, limits, anti-cycle, and faults shall be assignable to each pump.
D. Auxiliary pumps: Quantity and mode of operation shall be configurable.
E. Lake Level Controls: Enable/disable lake level controls. Selectable operation from probes or analog level transmitter. Delay times, and analog set points if analog mode is chosen.
F. Inlet Screen: Enable/disable with flow and flush parameters.
G. Chemical Injection: Enable/disable with flow set point and scaling parameters.
H. Station Filter: Enable/disable with flow and flush parameters.
I. Station Safeties: Enable type of safety and associated time parameters and operational set points. System should contain the following safeties:
    1. Pump Protection: Consist of selectable low level, low inlet, or loss of prime. High Pump Temp for horizontal pumps.
    2. Station Safeties: Low/high Discharge pressure set points, phase fail and VSD fault.
J. Analog Scaling: Analog inputs shall be able to be scaled for min/max for raw and scaled values.
K. I/O Mapping: All PLC inputs/outputs regardless of type can be assigned from the HMI.
L. All data accessible through HMI shall be available with remote access.

9.13 Operation Setup

The operation parameters are configurable and settable based on the operating needs of the site system.

A. Pump Sequence: Settable parameters to set the start/stop for the sequence of pumps that includes pressure/flow set points and timers to verify required operation. This includes transition speeds and timing when starting/stopping lag pumps. Includes configuration of flow stop parameters.
B. Variable Speed Bypass: Start/stop set points which include delay timer settings for configuration when the variable speed drive is in bypass mode.
C. PID Turning: Includes tuning parameters for different PID loop requirements and advanced PID tuning of a minimum of 3 pressure ranges. Includes status indications and trend graphing to assist in the tuning process.
D. VSD Controlled Shutdown: Configurable parameters to add a smooth transition to an off state.
E. High Pressure Check: System parameters to verify if flow demand exists and at what point to shut the system down to no flow demand.
F. Line Fill: Configurable set points to allow slow filling of the distribution system during the initial startup or recovery after power failure.
G. Lockouts: Time and day of the week settings to restrict the number of pumps that may operate during the restrictive times. Maximum pressure and VSD speed are configurable set points. The lockouts can be enable/disabled.
H. Time/Date Configuration: Allows sync of real time clock of PLC with HMI and allows manual setting of the time and date.

9.14 Maintenance

Settings to assist in troubleshooting and repairing of the control system.

A. Project Documentation: HMI must include the ability to store and view PDFs from the touch screen display. This includes manuals, a bill of materials and drawings. It shall be a requirement that the manufacturer provide these deliverables within the HMI.
B. Pump Sequence Logic: Provides status indications of what current step the program is in and the amount of the high-pressure accumulator. This screen also provides for temporally overriding the amount of pump run time. The alternation of pumps is based on least run time, and this provides a method to either have a pump run more or lease often.

C. Lamp Test: Provides a method to test all lighted panel devices with one push button.
D. Email Setup: When connected to the internet the system shall provide the ability to send email and text messages due to an assignable fault occurrence. It also provides the ability to attach the event log for review. A configuration screen is provided for input of the required parameters.

9.15 Operation

Screens provide indication of the system operation, events, alarms, trends, and totalizes.

A. Dashboard: Screen will provide indication of the system's current state. Display shall provide current flow, pressure, set point, VSD speed, pump status, pump run time, and status indicators for auxiliary controls.
B. Current Alarms: Displays any current alarms with time/date stamp of occurrence.
C. Historical Alarms: Displays historical alarms with time/date stamp of occurrence. Additional information that is captured with each alarm is flow rate, pressure, status and operational method of each pump, and speed of the VFD. The last 100 alarms are stored on PLC memory and are viewable through the HMI.
D. Trends: Trend screen provides trending information of pressure set point, PID set point, Pressure, VSD speed & flow rate. The status of each pump is trended that will provide indication of pump is running or off and if the pump is operating across the line or on the VSD. HMI must be able to store 300,000 Points of trend data for trend view.
E. Historical Events: Displays historical event occurrence and the status of the system at the time of the event. The event is time/date stamped. System conditions such as flow, pressure, set point, VSD speed and pump status are reordered with each event. The last 200 events shall be stored on the PLC memory and shall be accessible for view through the HMI. All historical events are logged to an HMI data log CSV file. A new data log file shall be created weekly. The data log file shall be capable of being extracted to be viewed on a PC with excel viewer program.
F. Totalizers: Provides current and two previous years cumulative totals for system flow and for each pump run times and number of starts. This is displayed in daily, monthly, and yearly totals.
G. Auxiliary Pumps: Enable time clock-controlled pumps or auxiliary devices. Start start/stop time per day. Day of week operation is selectable.
H. The dashboard shall also be configured to provide each pump's status.
I. Help Screen: Provides contact information for MCI Pump Service Group to provide 24/7 phone support and field support.

9.16 Remote Cellular Connection

A. Unit shall be provided with a cellular modem to provide a remote connection via the internet utilizing any smart phone, tablet or PC that is capable of connection to the web.
B. This system shall not require any modification to the pump station control system to install and operate this feature.
C. The cellular package shall be an MPC-RCM as provided by Motor Controls, Inc. of Dallas, TX.
D. The MPC-RCM will provide a cellular modem, antenna and first year of service included with this option. No additional software changes shall be allowed.

11.00 Site Ready Pump Station Shelter

11.01 Construction

A. The pumping system shelter shall be a durable, corrosion-resistant, fabricated unit with an extruded, lightweight aluminum structure comprised of die-cast joints and fittings, formed walls, roof panels, and doors. All shelters must be engineered by the same manufacturer as the pump station. The shelter must be fabricated and assembled in the same facility as the pump station.

B. Shelter roof and walls shall be manufactured from marine grade 5052 aluminum, at least .100” thick, and formed for rigidity. Panels shall be riveted or bolted together and include full length gasketing along all sealing surfaces to prevent leaks.

C. Walls, doors, and ceiling shall be insulated with one-inch expanded urethane foam insulation providing an insulation value of R-6 or better. All foam insulating surfaces must be sealed from contact with the ambient shelter environment. No raw foam surfaces shall be left exposed.

D. The roof shall include a gable design. All pumps must be able to be installed and removed without the need to detach the entire shelter roof. Any elevated surface an operator is expected to access must be provided with some type of anti-slip protection for increased user safety.

E. Shelter shall include double and single width doors as needed to provide full access to the mechanical and electrical components for adjustment and maintenance. Doors shall include latches, lockable by padlock.

F. All doorways shall be constructed with rigid doorstops to prevent damage and promote accessibility while accessing the system.

G. All shelter doors must be manufactured with a resilient compression style latching hinge that can allow for the total removeable of the doors without the use of special tools.

H. Shelter frame and panels must be electrostatically powder coated for added corrosion resistance.

I. Shelter hinges shall be of a robust metal design and access handles shall be fiberglass reinforced with nylon.

J. All aluminum extrusions shall be deburred following cutting.

H. Piping shall be routed through the wall of the shelter. Holes shall be provided in wall at least 1/4" larger in diameter than the OD (Outer Diameter) of the piping passing through. Pump station manufacturers shall provide escutcheon plates around the piping as required to provide a barrier to external environmental conditions.

11.02 Climate Control System

A. Exhaust fan and inlet louver - Exhaust fan shall be a high-capacity direct drive propeller wall mounted fan. The fan must be capable of automatically regulating the internal shelter temperature. Fans shall come complete with a wall collar and exhaust damper. Inlet louver shall be included with a fixed damper. Exhaust fan and louvers shall be provided with guards to prevent rodent intrusion.

B. Station Heater - The manufacturer shall provide a three-phase pre-mounted and pre-wired line voltage driven 5 kW heater. The unit shall be provided with a thermostat and short circuit protection.

11.03 Electrical System

A. All conduit and wiring shall be installed in accordance with the latest edition of the National Electric Code. All internal shelter wiring shall be complete prior to delivery to site by the pump station manufacturer.

B. Fusible disconnect switch - A NEMA 4X stainless steel service entrance rated fusible disconnect switch shall be supplied on the outside of the shelter allowing an immediate means of disconnecting main power from the system. Conduit and wiring from the switch shall be installed and connected by the pumping system manufacturer to the enclosed control panel.

C. Station Power Supply - The pump station manufacturer shall provide an auxiliary power zone prewired and mounted on the skid capable of delivering 240/120-volt single phase power needed to support all shelter and customer loads without overloading.

D. All main service wiring to the control panel shall be housed in schedule 40 PVC conduit.

E. One ground fault receptacle shall be provided for customer use.

F. Dual lamp LED lights shall be installed to deliver optimum lighting and shall be controlled by a light switch mounted near the door.

12.15 Unloading and Setting Supervision. Setting of the pumping system and anchoring of the pumping system shall be the responsibility of the contractor. Crane to off-load and set the pumping system onto the concrete slab shall be provided by installing contractor. Installing contractor shall supply a technician for one day to meet the shipment, unload and set the pumping system.

12.16 Intake Piping. The Contractor shall be responsible for the installation and supply of a 12" ductile Iron Pipe Between pump station and lake with 24" of cover. Provide and install 120' of 12" Dr 17 HDPE pipe I lake. Povide Aluminum submersible sled with 8" Valmatic swing flex check valve and SS 30" box screen. Provide diving crew to install intake piping and check valve sled.

12.17 Concrete Slab. Install 20' X 17' Monolith Slab 12" thick. 4000 Psi Concrete. #5 Rebar 12" on center and 45 degree Chamfer on all edges.

12.18 Electrical. Upgrade existing 200 amp service to 400 amp.Install new condit and wire for 400 amp service from existing location to new pump location. 425' appx.

12.19 Existing Station Removal. Remove the existing pump station and controls to maintenance location. Provide and install steel plate to cover existing wet well.. Remove fencing and existing slab.

12.20 Lake Fill Control Valve and vault.

- Provide a 4" Cla-val Valve with 24vdc solenoid which will be controlled from the main pump station.
- Set and install a 4' dia. X 4' deep concrete manhole with a 30" x 30" Alum Hatch. The manhole will be located where the city water line enters the irrigation pond.
- Provide 4" Ductile iron piping inside manhole and reconnect to existing PVC outside manhole.
- Install wire and conduit between the main pump station and the 4" control valve.
- Distance – 550'

13.20 Start Up. When discharge piping, electrical connections, and electrical inspection have been completed, the pumping system manufacturer shall be contacted for startup. A minimum of one-week notice shall be given to manufacturer prior to scheduled startup date. During start up, the complete pumping system shall be inspected for proper installation and shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration or overheating and shall demonstrate its general fitness for service. All defects shall be corrected, and adjustments made at the expense of the pumping system manufacturer. Test shall be repeated until satisfactory results are obtained. Startup assistance shall be provided but shall be limited to one 8-hour day.

After the station startup has been completed, but before the technician leaves the job site, a training session shall be given to the owner or the owner's representative to familiarize them with the pumping system operation, maintenance and adjustments.

13.25 Warranty.

A. **The manufacturer shall warrant that the water pumping system shall be free of defects in workmanship for a period of two years from date of authorized start-up but not to exceed thirty months from date of manufacturer's invoice. Variable frequency drive and control panel shall be provided with a 6-year warranty as described in the VFD section above and shall include protection against lightning strikes and electrical surges. The Installing contractor shall warrant the installation and all non-manufacturer installations for a period of one year upon final inspection.**

B. Provided that all installation and operation responsibilities have been properly performed, manufacturer shall provide a replacement part or component during the warranty life. Any repairs to be accomplished at manufacturer's expense must be pre-authorized. The start-up certificate must be on file with manufacturer to activate warranty. Upon request, manufacturer shall provide advice for trouble shooting of a defect during the warranty period.

C. Manufacturer shall use only first quality material. As with any mechanical or electrical device, some preventive maintenance efforts are required to assure an adequate service life. A periodic preventive maintenance program recommendation shall be included in the owner's manual. Manufacturer shall support a large national network of technical service technicians. Manufacturer's field service technicians shall be contacted for service. Because of varied conditions beyond the control of manufacturer, this warranty may not be valid or may not cover damage as follows:

1. Default of any agreement with manufacturer.
2. Misuse, abuse, or failure to conduct routine maintenance.
3. Handling any liquid other than clean water.
4. Exposure to electrolysis, erosion, or abrasion.
5. Presence of destructive gaseous or chemical solutions.
6. Over voltage or unprotected low voltage.
7. Unprotected electrical phase loss or phase reversal.

.

TECHNICAL SPECIFICATIONS

Prefabricated Vertical Turbine Irrigation Pumping System

System Model No:	PPS-N-ES2-1200-120-SV-P-48-3-6

Project Name	Fendrich GC
Project Location	Evansville, IN
Irrigation Consultant	Tony Altum
Station Type	VARIABLE SPEED HORIZONTAL PUMP STATION

QTY of Pumps	3

Variable Frequency Drive

Operating Temperature	-10C to 50C (14F to 122F)
Humidity	95% Non-Condensing
Output Voltage	0-100% of Supply Voltage
Minimum Efficiency	98%
Harmonic Mitigation	3% Input Impedence
Frequency Rating	100% Continuous Drive Rating - 110% Max for 60 Seconds

Station Power Supply

Voltage	Phase	HZ
480	3	60

System Hydraulic and PSI Requirements

Zone	Zone Type	Flow (GPM)	Pressure (PSI)	CFM	Total HP
1	LIFT	1200	120	3267	155

Station Pressure Relief

ZONE	INCLUDE?	SIZE	TYPE	SETTING	DISCHARGE LOCATION
1	YES	3"	ANGLE	20 - 200	SUCTION MANIFOLD

Zone 1 Power Requirements

Equipment	HP	Motor Type	KVA	FLA	CFM	Voltage	Phase	HZ	QTY
Main	75	SURFACE	80	96	1200	480	3	60	2
PM	5	SURFACE	6	8	80	480	3	60	1
CPT			1	3		480	1	60	1
Station Heater	Watts:	5000	5	11		480	3	60	1
Control Panel Totals	155		172	214		480	3	60	1
Power Pack			5	11	787	480	1	60	1
Total System Requirements	155		177	225	3267	480	3	60	1

Main Disconnects

Zone	Total Control Panel Requirements	Voltage	SE Rated
1	400	480	YES

Auxilliary Power Supply Equipment

Equipment	Rating	Output	Circuit Breakers
Zone 1 Power Pack	5	120/230 1ph	(4) 1-Pole 15A, (2) 2-Pole 20A

Touchscreen Operator Interface

Color	Size/Type	Web Server Active
X	12" TFT	Yes

Zone 1 Motor Data

	Main	PM
Motor HP	75	5
Motor SF	1.15	1.15
Motor RPM	3600	3600
Motor Efficiency	95.00	89.5
Motor Power Factor	85.00	80
Motor Type	ODP	TEFC
Space Heater?	Yes	Yes
Motor FLA	96	7.6
Starter Type	VFD/XL (SHR)	XL
Motor Volts	480	480

Zone 1 Pump Data

	Main	PM
Pump GPM	600	36
Pump TDH	298	298
Design Efficiency	78.40%	62.60%
Shut off head	362	465
Pump Suction Size	4	1.25
Pump Discharge Size	2.5	1.25
Seal Type	MECHANICAL SEAL	MECHANICAL SEAL
Check Valve size	6"	2"
Max Sphere Size	0.5"	0.00"
Impeller material	Cast Iron	304SS
CV Flow Coeficient	520	43
Check PSI Rating	400psi	400psi
Check Valve PSI Drop	0.576	0.303
Suction Iso Valve Size	8"	2"
Discharge Iso Valve Size	6"	2"
Iso Valve Rating	300 PSI	300 PSI

Pump Impellers shall be 316SS Investment Cast Pump Shafting shall be 416SS minimum
Shaft and Columns shall be maximum 5' in length - 10' lengths shall not be allowed

Safeties

Safety	Setting
Incoming Phase Failure/ Low Voltage/Phase Reversal	10% +/-

Individual Power Phase Failure and Low Voltage		10% +/-
Low Discharge Pressure Shutdown		25 PSI Below SP - Manual Reset
High Discharge Pressure Shutdown		15 PSI Above SP - Auto Reset
[redacted]	LOSS OF PRIME	No Prime - Auto Reset

Station Discharge Design

ZONE	Iso Valve Size	Flowmeter?	FM Spool Size	FM Type
1	6"	YES	6"	MAGMETER

Station Discharge Transition piping

Zone	Required?	Size	Angle	TOL's/ Qty/Size	End Connection
1	YES	6" x 12"	90°	QTY (2) Quick-Vic-Victaulic Couplers, QTY (6) 3/4 IN Thread-O-Lets and QTY (2) 2 IN Thread-O-Let	PLAIN
90 degree transition piping to include swivel clamp					

Communications

Hardwire	Radio	Ethernet	Cellular	Irrigation Central
YES	NO	NO	YES	CELL

Fertigation

Lake Level Control

Sensor Type	Qty
TRANSMITTER	1

Site Conditions

Station Altitude	400		MSL
Derate Required?	NO	0%	% Derate
MAX LIFT (FT)	6		