

WOLF SWAMP PARK
LONGMEADOW, MA

2.32 WATER SUPPLY ISOLATION VALVES

- A. Isolation valve for water supply shall be flanged resilient wedge ductile iron gate valve with non-rising stem, US Manufacture.

2.33 WATER SUPPLY ENCLOSURE

- A. Enclosure shall be of a vandal and weather resistant nature manufactured entirely of aluminum with 1-1/2-inch insulated aluminum with locking hasp.
- B. Enclosure shall contain two (2), 120-volt, 1000-watt heaters with thermostat switch capable of maintaining 4°C (40°F) inside the enclosure when subjected to 34°C (-30°F) outside air temperature.
- C. Enclosure shall be designed to support a minimum vertical load of 100 lb./sf.
- D. Depth of water within the enclosure shall not exceed 6 inches during full flow of the backflow preventer relief discharge.
- E. Enclosure shall be designed to be accessed and provide sufficient room for testing and maintenance; shop drawings shall be submitted from the manufacturer.
- F. Enclosure shall meet ASSE Standard 1060.
- G. The enclosure interior dimensions shall be 85 inches long x 55 inches wide x 57 inches tall. Unit shall be as manufactured by Hubbell Systems, Hot Box, Model HB3E-DS.

2.34 PRESSURE GAUGE

- A. Pressure gauge shall be glycerin filled with accuracy conforming to ANSI Grade B or greater. Gauges shall be provided minimum on main discharge pipe before and after wye strainer.

2.35 CONCRETE/CONCRETE BASES

- A. Concrete bases shall be standard concrete mix in accordance with ASTM C150, ASTM C-33, and ASTM C-94 with a compressive strength (28 days) of 3,000 psi.
- B. Cement concrete for thrust blocks shall be 3,000 psi, 1-1/2-inch aggregate.
- C. Concrete base for controller enclosure shall be 24-inch x 24-inch x 6 inches deep as indicated on the detail.
- D. Concrete base for water supply enclosure shall be 68 inches long x 38 inches wide x 6 inches deep.
- E. Bases shall be installed on minimum 6-inch crushed stone.

2.36 CRUSHED STONE

- A. 1/2-inch crushed stone shall be washed at the source facility to remove fine-grained soils and shall be well graded within the following limits:

Sieve Size (ASTM D422)	Percent Passing by Weight
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3/4 inch	100
1/2 inch	90-100
3/8 inch	0-20
No. 4	0-5

2.37 SAND

- A. Shall consist of well-graded natural sand, free from organic, other weak or compressible materials, or frozen materials, conforming to the following gradation:

Sieve No.	Percent Passing by Weight
#8	100
#50	15-40
#100	2-10
#200	0-5

2.38 SPARE PARTS

- A. Supply the following tools and equipment to the Owner's Representative before final observation:
1. Two (2) wrenches or keys for disassembling and adjusting each type of sprinkler provided.
 2. Four (4) quick coupler key assemblies.
- B. Before final observation can occur, written evidence that the Owner's Representative has received the tools and equipment must be shown.

PART 3 - EXECUTION

3.1 GENERAL

- A. Before work is commenced, hold a conference with the Owner's Representative to discuss general details of the Work.
- B. Examine Contract Documents applying to this Section noting any discrepancies and bringing the same to the attention of the Owner's Representative for timely resolution.
- C. Work indicated on drawings shall be provided whether or not specifically mentioned in the specifications.
- D. If there are ambiguities between drawings and specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification will be made only by Owner's Representative, and compliance with the decisions shall be required. In the event the installation contradicts the directions given, the installation shall be corrected at no additional cost to the Town of Longmeadow.
- E. Verify dimensions and grades at job site before work is commenced. Do not proceed with installation of the irrigation system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend or specific notes are discovered. Such obstructions, conflicts, or discrepancies shall be brought to the attention of the Owner's Representative.

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- F. Make field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades. Project shall be laid out essentially as indicated on the Irrigation Plans. Major changes shall be reviewed with the Owner's Representative prior to proceeding.
- G. Layout of sprinklers and sprinkler lines indicated on drawings is diagrammatic. Location of sprinkler equipment is contingent upon and subject to integration with other underground utilities and the final field layouts. Employ data contained in the Contract Documents and verify this information at the construction site to confirm the manner by which it relates to the installation.
- H. Coordinate installation of irrigation materials, including pipe, to avoid conflict with trees, shrubs or other plantings.
- I. During progress of work, a competent superintendent and assistants necessary shall be on site and shall be satisfactory to the Owner's Representative. The superintendent shall not be changed, except with the consent of the Owner's Representative, unless that person proves unsatisfactory and ceases to be employed. Directions given to the superintendent shall be binding.
- J. Protect new and existing paving, structures, walls, footings, etc. from damage. Inadvertent damage to the work of another trade shall be reported at once.

3.2 PIPE AND FITTINGS INSTALLATION

- A. Using proper equipment, excavate a straight (vertical) and true trench to a depth of 2-inch of pipe invert elevation.
- B. Loam or topsoil encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the drawings and stockpiled for subsequent replacement in the upper 6 inches of the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed therefore.
- C. Pipe shall be laid on undisturbed trench bottom provided suitable base is available - no rock; if not, excavate to 2-inch below pipe invert and provide and install sand base or crushed stone upon which to lay pipe.
- D. Backfilling shall be accomplished as follows: backfill material shall contain no foreign matter and no rock. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be laid-up in 6-inch (maximum) lifts and tamped to compaction with mechanical equipment. Compact backfill in trenches to dry density equal to the adjacent undisturbed soil, and conform to adjacent grades without dips, sunken area, humps, or other irregularities. Frozen material shall not be used for backfill.
- E. Clean bell and spigot ends and make gasketed joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of lubricant, and wiping off any excess lubricant from each connection. Maximum deflection per joint shall not exceed manufacturer's recommendations.
- F. Make solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow welded joints at least 15 minutes set-up/curing time before moving or handling. When the temperature is above 80° F, allow connections to set minimum 24 hours before pulling

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or pressure is applied to the system. When temperature is below 80° F, follow manufacturer's recommendations. Provide and install for expansion and contraction as recommended. Wire shall be laid in same trench as mainline and at pipe invert (see Wire Installation).

- G. Mainline, cistern potable water pipe and well supply pipe shall have minimum 22 inches of COVER (excavate to invert as required by pipe size). Lateral pipe shall have minimum 16 inches or COVER (excavate to invert as required by pipe size).
- H. Cut plastic pipe with handsaw or pipe-cutting tool, removing burrs at cut ends. Pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's specifications.
- I. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times, when installation of the pipe is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. Pipe which cannot temporarily be joined, shall be sealed to make as watertight as possible. This provision shall apply during the lunch hour as well as overnight. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the pipe, no additional pipe may be installed or backfilled until water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is occurring, or when the ambient temperature is at 40° F or below. Pipe installed at temperatures below 40° F shall be removed and replaced at no cost to the Town of Longmeadow. Pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.
- J. Maintain 6-inch minimum clearance between sprinkler lines and lines of other trades. Do not install sprinkler lines directly above another line of any kind.
- K. Maintain 1-inch minimum between lines which cross at angles of 45 to 90 degrees.
- L. Throughout the guarantee period refill any trenches that have settled due to incomplete compaction.
- M. Pulling of pipe, 2-1/2 inches and below, will be allowed provided soil is suitable and specified depth of bury can be maintained.

3.3 THRUST BLOCKING

- A. Ringtite bell-end fittings, pump station outlet pipes and isolation valves shall be blocked with an adequately sized thrust block as per ASAE Standard S376.2 and as depicted in the details. Blocking shall be in accordance with pipe and fitting manufacturer's recommendations. Thrust blocks shall be required at changes in size and direction of bends, reducers, plugs and tees. Thrust blocks shall be installed against undisturbed soil. Concrete thrust blocks shall utilize 3,000-psi standard concrete mixture. Bricks, stones, boulders, etc. will not be accepted as thrust blocks or thrust block material. Sakrete will not be permitted as a thrust blocking material. Supply material needed for thrust blocking.
- B. Size of thrust block shall be determined by working pressure, size and type of fitting, and soil conditions. Calculate area required for concrete thrust block in contact with soil. Refer to fittings manufacturer's thrust block sizing table to determine size of thrust block for each condition.
- C. Ensure stability of thrust blocks.
- D. Under no circumstances will concrete block be approved for thrust blocks.

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3.4 ELECTRICAL WIRE CONDUIT INSTALLATION

- A. Electrical conduit shall be installed in non-soil areas, as well as for above ground wiring where wire passes under or through walls, walks and paving to controller, pump station and weather sensor.
- B. Conduit shall extend 18 inches beyond edges of walls and hardscapes.

3.5 PIPE SLEEVING INSTALLATION

- A. Sleeving shall be installed wherever pipe is going under non-soil areas and where indicated on the drawings. Minimum cover over sleeving pipe shall be 24 inches as shown on the detail.
- B. Sleeving shall extend 18 inches beyond edges of walls and pavement/pavers. Prior to the installation of irrigation pipe and wiring, the ends of sleeving shall be field marked with a vertical wooden stake extending above grade to allow field location at the time of irrigation installation.
- C. Ensure required sleeving is installed prior to starting any pavement/paver operations. Review sleeve locations in the field to confirm that sleeves are properly located for the required irrigation pipe runs. In no case will saw cutting into newly installed pavements/pavers or jacking under new pavements/pavers be permitted to install sleeving which was not installed in proper sequence or in the required orientations or locations.

3.6 ISOLATION VALVE INSTALLATION

- A. Install isolation valves per detail where indicated on the drawings. Install isolation valves on a level crushed stone base so that they can be easily opened or closed with the appropriate valve wrench. Install specified valve box over each isolation valve.
- B. Check and tighten valve bonnet packing before valve box and backfill installation.
- C. Provide and install thrust blocks for ringtite valves as per detail.

3.7 VALVE BOX INSTALLATION

- A. Furnish and install a valve access box for each electric valve, flow meter, master valve, quick coupling valve, isolation valve and wire splice.
- B. Valve access boxes shall be installed on a minimum 4-inch crushed stone base. Finish elevation of boxes shall be at grade. Supply crushed stone and install before valve box. Crushed stone shall not be poured into previously installed valve boxes.
- C. Valve boxes shall be installed neatly. Boxes shall be parallel or perpendicular to hardscape edges and equidistance to other valve boxes installed in the same location. A sufficient amount of turf shall remain in place between each valve box and between valve boxes and hardscapes
- D. Valve box extensions shall be provided as required on valve boxes in order to install valve box covers at grade.
- E. Bricks, stones, etc. shall not be used to support valve boxes.

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- F. Install isolation valves per detail where indicated on the drawings. Install isolation valves on a level crushed stone base so that they can be easily opened or closed with the appropriate valve wrench. Install specified valve box over each isolation valve.
- G. Check and tighten valve bonnet packing before valve box and backfill installation.
- H. Center valves in valve boxes for servicing.

3.8 24 VOLT CONTROL VALVE INSTALLATION

- A. Control valves shall be installed on a level crushed stone base. Grade of bases shall be consistent throughout the project so that finish grades fall within the limits of work. Valves shall be set plumb with adjusting handle and bolts, screws and wiring accessible through the valve box opening. Valves shall be set in a plumb position with 24-inch minimum maintenance clearance from other equipment.
- B. Install at sufficient depth to provide more than 6-inch, nor less than 4-inch cover from top of valve to finish grade.
- C. MPRotator zones shall include filters installed after the valves.
- D. Adjust zone valve operation after installation using flow control device on valve.

3.9 WIRING INSTALLATION

- A. Sufficient slack for expansion and contraction shall be maintained and wiring shall at no point be installed tightly. Provide and install an additional 8 inches to 12 inches slack at changes of direction. Wiring in valve boxes shall be a sufficient length to allow the valve solenoid, decoder, splice and connections to be brought above grade for servicing. This additional slack shall be coiled for neatness in the valve box.
- B. Wire shall be laid in trenches and shall be carefully backfilled to avoid any damage to the wire insulation or wire conductors themselves. In areas of unsuitable material, the trench shall have a 2-inch layer of sand or stone dust on the bottom before the wires are laid into the trench and backfilled. The wires shall have a minimum of 22 inches of cover (See Detail). Wire not to be installed that day shall not be laid out.
- C. An expansion curl shall be provided and installed within 6 inches of each wire connection to a solenoid or decoder on the #14 wire – do not curl two-wire communication cable. Expansion curls can be formed by wrapping five (5) turns of wire around a 1-inch diameter or larger pipe and then withdrawing the pipe.
- D. Service wiring in connection with drawings and local codes for low voltage service. In-ground wire connections shall be waterproofed splice kits. Splices shall be made in valve boxes (wire runs requiring splices between valve locations shall be provided and installed in splice box-valve box shall be used). Splice locations shall be shown on the record drawings.
- E. Provide a complete wiring diagram showing wire routing for the connections between the controller and valves. See section one for the inclusion of wiring diagram in operation and maintenance manuals.
- F. Two-wire communication cables (orange and blue) shall be installed along mainline path and indicated on the record drawings separately.

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3.10 CONTROLLER AND ENCLOSURE INSTALLATION

- A. Install controller in enclosure, per detail using Hunter ACC Kit (#621215) or equal for the Strongbox or equal enclosure. Wire decoder cables and weather sensor into controller and set proper programs.
- B. Wire controller to electrical supply at controller location from building circuit provided by the Town of Longmeadow.
- C. Controller shall be mounted in the specified VIT Strongbox or equal stainless-steel enclosure. Wiring within the enclosure shall be neatly run, bundled, and cinched.
- D. Controller shall be installed on a new reinforced concrete base of minimum dimensions shown on the detail, poured-in-place. Expansion shields shall not be used. Contractor to use template to install poured-in-place stainless steel "J" bolts to fasten enclosure to base. Prefabricated controller base shall not be approved for installation. Controller shall be installed on the pad to allow the operator to stand on the pad in front and back of the controller during programming and maintenance.
- E. Install minimum one (1), 2-inch PVC conduit sweep ell and spool piece through controller pad as required for decoder cables. Install minimum one (1), 1-1/2-inch PVC conduit sweep ell and spool piece through controller pad for #6 AWG bare copper wire. Install minimum one (1), 1-inch PVC conduit sweep ells and spool pieces through controller pad for power. Maintain required depth of bury in/out of pad.
- F. Controller power wire, decoder cable, flow sensor cable and #6 AWG bare copper wire shall be brought to the exterior through separate sleeves in the support pad. Grounding wire shall be installed through the controller concrete pad through a separate 1-1/2-inch sleeve and not through the controller enclosure.
- G. Contractor shall install control and other irrigation-related wiring,; as well as 120-volt service to controller.
- H. Above ground wire, other than in controller enclosure shall be installed in conduit.
- I. Grounding system shall be minimum as specified and installed per manufacturer's recommendations. A third party shall certify in writing after testing the results of the grounding system megging readings.
- J. Surge arrestor ground shall be installed per manufacturers installation instructions.
- K. Seal enclosure sweep holes with expandable foam insulation.
- L. Controller shall be installed level on pad and tight to the base (no gaps).
- M. Keys shall be turned over to Owner's Representative.

3.10 WIRELESS WEATHER SENSOR INSTALLATION

- A. Install weather sensor on exterior of building on roof eave in sensor guard, where indicated on the detail. Weather sensor shall be in direct contact with the weather and not in contact with the irrigation spray. Weather sensor shall be installed on eave so as not to be obstructed from the prevailing wind and so that the freeze sensor points south.

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- B. Firmly attach weather sensor receiver within bottom section of the controller enclosure.

3.11 FLOW SENSOR INSTALLATION

- A. Irrigation mainline flow sensor shall be installed with accompanying saddle on 6-inch PVC pipe where indicated on the drawings in jumbo valve box upstream of the master valve. Wire water supply flow meter to pump control panel and then Hunter ACC or equal controller with ICD-SEN decoder in series per manufacturers requirements.
- B. Water supply flow sensor shall be installed in a 3-inch PVC saddle on PVC pipe where indicated on the drawings in standard valve box. Wire flow meter to pump control panel per manufacturers requirements.

3.12 MASTER VALVE INSTALLATION

- A. Master valve shall be installed on the exterior PVC mainline pipe where indicated on the drawings downstream of the quick coupler and isolation valve using ductile iron fittings and reducers.

3.13 GROUNDING INSTALLATION

- A. Grounding rods shall be driven into the ground their full length 12-feet from controller and 8-foot for surge arrestors and connected via exothermic connections to #6/#10 solid, bare copper wire. The copper wire is to be installed in as straight a line as possible, and if it is necessary to make a turn or bend, it shall be done in a sweeping curve with a minimum radius of 8 inches and a minimum included angle of 90 degrees. There shall be no splices in the bare copper wire. The top of the ground rods shall be driven below the ground surface. A 4-inch grated cover as specified, set a minimum of 1-inch below grade, shall be placed over the ground rods and exothermic connection for periodic maintenance. Covers shall be installed on a minimum of 6 inches of 4-inch corrugated polyethylene, perforated drainage pipe. Plates shall be installed 36 inches below grade with 50 lbs. of ground enhancement material spread evenly below the plate and 50 lbs. of ground enhancement material spread evenly above the plate for the controller and 25 lbs. of ground enhancement material spread evenly below the plate and 25 lbs. of ground enhancement material spread evenly above the plate for the surge arrestors in accordance with the manufacturer's requirements. Plates shall also be covered with a 4-inch grated cover as specified, set a minimum of 1-inch below grade, to facilitate drainage onto the plates. Covers shall be installed on a minimum of 36 inches of corrugated polyethylene, perforated drainage pipe.
- B. When tested, grounding grid shall have an earth resistance no greater than 10 ohms. If earth resistance is greater than 10 ohms, additional grounding rods and/or plates and enhancement material shall be added to system until desired test results have been met.

3.14 SPRINKLER INSTALLATION

- A. ½ and ¾-inch sprinklers shall be installed flush (perpendicular) to grade on swivel joint assemblies.
- B. Large rotary sprinklers shall be installed flush to grade on 1-inch prefabricated PVC unitized swing joint assemblies with integral O-rings, minimum length 12 inches.
- C. Sprinklers shall not exceed maximum spacing indicated.
- D. Adjust sprinkler zone after installation using flow control device on valve.

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3.15 AIR VACUUM/RELEASE VALVE INSTALLATION

- A. Install air vacuum/release valve as per detail at location shown on the drawings.
- B. Provide ball valve shut-off, boiler drain and wye strainer under air vacuum/release valve as per detail. Ball valve shut-off shall be easily accessible through the valve box. Install boiler drains on discharge of wye strainers.
- C. Drill thirty-two (32), 3/8-inch holes in air vacuum/release valve box covers for air passage.
- D. Air vacuum/release valve shall be installed straight up from mainline and not on the side.

3.16 QUICK COUPLING VALVE INSTALLATION

- A. Provide and install quick coupling valves where indicated on the drawings.
- B. Quick coupling valves to be mounted on 1-inch prefabricated PVC unitized swing joint assemblies with integral O-rings, minimum length 12 inches with brass insert and stabilizer as per details.

3.17 ENCLOSURE INSTALLATIONS

- A. Install enclosures on concrete bases as indicated on the details, where indicated on the drawings. Final location of enclosures shall be coordinated with the Owner's Representative as to best screen the enclosures and deter vandalism.
- B. Concrete base for controller enclosure shall be minimum 24 inches wide by 24 inches deep by 6 inches thick. Base shall be installed on a minimum 6-inch crushed stone per details.
- C. Concrete pad for water supply enclosure shall be minimum 97 inches long by 676 inches wide by 6 inches thick. Base shall be installed on a minimum 6-inch crushed stone per details.
- D. Install two (2) 8-inch Schedule 40 sleeves through concrete pad into enclosure for water in and irrigation out as per detail.
- E. Install two (2) 2-inch and one (1) 1-inch Schedule 40 electrical conduits through concrete pad into enclosure for heaters and actuator valve as per detail.

3.18 WATER SUPPLY INSTALLATION

- A. Install modulating butterfly valve, water meter, backflow prevention device, pressure gauge and associated pipe and valves in enclosure as outlined on the detail.

3.19 CHECK/TEST/START-UP/ADJUST

- A. Flushing:
 - 1. After pipe, valves, sprinkler bodies, pipes and risers are in place and connected, but prior to installation of sprinkler internals open the control valves and flush out the system under a full head of water.
 - 2. Sprinkler internals shall be installed only after flushing of the system has been accomplished to the full satisfaction of the Owner's Representative.

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3. Flush the entire system after installation is complete and service any clogged nozzles for thirty (30) days after substantial completion of this portion of the irrigation system.

B. Testing:

1. Leakage test: test lines for leaks under operating pressure. Repair leaks and re-test.
2. Coverage test: perform a coverage test in the presence of the Owner's Representative (notify Owner's Representative at least seven (7) days in advance of scheduled coverage test). Representative will determine if the water coverage is complete and adequate. Readjust sprinklers and sprinkler locations as necessary or directed to achieve proper coverage.
3. Testing shall be at no additional expense to the Owner.

3.20 CLEANING AND ADJUSTING

- A. At the completion of the work, parts of the installation shall be thoroughly cleaned. Equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge which may have accumulated by the operation of the system for testing.
- B. Adjust sprinklers, valve boxes and quick coupling valves to grade as required, so that they will not be damaged by maintenance operations.
- C. Continue sprinkler coverage adjustment as required by settlement, etc., throughout the guarantee period.
- D. Each control zone shall be operated for a minimum of 5 minutes and sprinklers checked for consistency of delivering water. Adjustments shall be made to sprinklers that are not consistent to the point that they match the manufacturer's standards. Sprinklers, valves, timing devices or other mechanical or electrical components, which fail to meet these standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

3.21 ACCEPTANCE AND OPERATION BY OWNER

- A. Upon completion of the work and acceptance by the Town of Longmeadow, train the Owner's Personnel in the operation of the system (provide minimum 7-day written notice in advance of test). Furnish, in addition to the record drawings and operational manuals, copies of available specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the irrigation system. Guarantee parts and labor for a minimum period of one (1) year from date of acceptance.

3.22 CLEAN UP

- A. Upon completion of installation work remove leftover materials and equipment from the site in a safe and legal manner.
- B. Remove debris resulting from work of this section.
- C. Regrade, lightly compact, and replant around sprinklers where necessary to maintain proper vertical positioning in relation to established grade.

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- D. Fill depressions and eroded channels with sufficient soil mix to adjust grade to ensure proper drainage. Compact lightly, and replant filled areas in accord with drawings requirements.

END OF SECTION

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SECTION 328410
IRRIGATION CISTERN/WET WELL & WELL PUMP SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Include GENERAL CONDITIONS and applicable parts of Division 1 as part of this Section.
- B. Coordinate work of this Section with other underground utilities and with trades responsible for their installation. Refer to respective drawings pertaining to other work.

1.2 WORK TO BE DONE

- A. Irrigation cistern/wet well pump system shown on the drawing and described within this specification represents a 220 gallon per minute (gpm) at 80-psi (185 feet of Total Dynamic Head (TDH)) system drawing from a cistern/wet well backed up by a combination of ground and potable water.
- B. Well pump system shown on the drawings and described within this specification requires 200 gpm at approximately at 175 feet of total dynamic head drawing water from an existing 8-inch well.
- C. Work to be done includes furnishing labor, materials, equipment and services required to complete cistern/wet well pump system work indicated on the drawing, as specified herein, or both.
- D. Electrical point of connection for the cistern/wet well pump system control panel shall be to an existing 480/277-volt, 3 phase, 100-amp electrical disconnect on the building exterior.
- E. Drawing and specifications must be interpreted and are intended to complement each other. Contractor shall furnish and install parts, which may be required by the drawing and omitted by the specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, Contractor shall refer the matter to the Owner's Representative for decision, and his interpretation shall be final, conclusive and binding.
- F. Work shall be constructed and finished in every respect in a good, efficient and substantial manner, to the full intent and meaning of the detail and specifications. Parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, shall be done or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.
- G. Operating & Maintenance Manual generation, in accordance to these specifications shall also be included in this work.

1.3 SHOP DRAWINGS

- A. Contractor shall provide copies of product specification sheets and shop drawings on proposed equipment to be installed to the Owner's Representative for approval prior to the start of work, in accordance with the parameters of this specification. Work on the cistern/wet well pump system may not commence until product sheets and shop drawings are submitted and approved. Submittals shall be marked up to show proper pump curve, sizes, flows, etc. Equipment to be included, but not limited to:

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1. Cistern/Wet Well
2. LinkSeals
3. Pump Station Pumps
4. Pump Station Motors
5. Well Pump
6. Manual Valves
7. Control Panel
8. VFD's
9. Starters (Well and Jockey Pumps)
10. Disconnects
11. Pressure Transducer
12. Wye Strainer/Screen
13. Flow Meters
14. Level Controls
15. Check Valves
16. Pitless Adapter
17. Pressure Gauges
18. Electrical Conduit
19. Foot Valve
20. Pressure Relief Valve
21. Grounding Equipment
22. Alarm Light
23. Listing of Alarms
24. Pump Station Enclosure
25. Fertigation System
26. Miscellaneous Materials

1.4 GUARANTEE

- A. Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. These guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.
- B. In addition to the manufacturers guarantees, warrant the cistern/wet well pump system, both parts and labor for a period of two (2) years from the date of acceptance by the Town of Longmeadow.
- C. Should any problems develop within the warranty period because of inferior or faulty materials or workmanship, they shall be corrected to the satisfaction of the Owner's Representative at no additional expense to the Town of Longmeadow.
- D. A written warranty showing date of completion and period of warranty shall be supplied upon completion of the cistern/wet well pump system installation and start-up.

1.5 COORDINATION

- A. Contractor shall coordinate his work closely with the Owner's Representative to avoid misunderstandings and to efficiently bring the cistern/wet well pump system installation to completion. Owner's Representative shall be notified as to the start of work, progression and completion, as well as any changes before the change is made.
- B. Contractor shall be held responsible for and shall pay for damage to other work caused by his work, workmen or sub-contractors. Repairing of such damage shall be done by the Contractor who installed the work, as directed by the Owner's Representative.

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1.6 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Contractor shall include in their Bid an allowance for four (4) hours of instruction of Town of Longmeadow's personnel upon completion of check/test/start-up/adjust operations by a competent operator (Owner's Representative office shall be notified at least one (1) week in advance of check/test/start-up/adjust operations).
- B. Upon completion of work and prior to application for acceptance and final payment, a minimum of three (3), three-ring, hard cover binders titled MAINTENANCE AND OPERATING INSTRUCTIONS FOR THE WOLF SWAMP ROAD IRRIGATION CISTERN/WET WELL PUMP SYSTEM, shall be submitted to the Owner's Representative office. After review and approval, the copies will be forwarded to the Town of Longmeadow. Included in the Maintenance and Operating binders shall be:
 - 1. Table of Contents
 - 2. Written description of cistern/wet well pump system.
 - 3. Listing of Manufacturers.
 - 4. Manufacturers' data where multiple models, type and size listings are included; clearly and conspicuously indicating those that are pertinent to this installation.
 - a. "APPROVED" submittals of equipment, including pump curves
 - b. Operation Procedures and set points
 - c. Maintenance: including complete troubleshooting charts.
 - d. Parts list.
 - e. User's manuals.
 - f. Names, addresses and telephone numbers of recommended repair and service companies.
 - 5. Start up and shut down procedures.
 - 6. Guarantee data.

1.7 QUALITY ASSURANCE

- A. Manufacturer: City of Longmeadow will not consider cistern/wet well pump system bids from manufacturers who have not successfully manufactured at least five (5) stations comparable to what is specified herein within the past three years.
- B. Installer: Firm that has at least five (5) years' experience in work of the size and type required by this section and which is acceptable to the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials to be incorporated shall be new and without flaws or defects and of quality and performance as specified and meeting requirements of system. Material overages at the completion of the installation are the property of Contractor and shall be removed from the site.
- B. No material substitutions from the products described in these specifications and shown on drawing shall be made without prior approval and acceptance from Owner's Representative.
- C. Provide manufacturers' products called for "or approved equal" in which case a product substitution to Owner's Representative shall be approved. Certain manufacturer's names and model numbers are used throughout these specifications to denote a standard. Alternate manufacturer's products are acceptable when products of equal or better quality and performance are submitted and approved as outlined below. Alternative products must be equal to, or better, to qualify as an "or approved equal" product.
- D. For each item proposed as equal, submit a request which includes:

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1. Drawings and samples as appropriate
 2. Comparison of the qualities of the proposed item with that specified
 3. Changes required in other elements of the work because of the substitution
 4. Name, address and telephone number of vendors
 5. Manufacturer's literature regarding installation, operation and maintenance
- E. Requests for approval constitute a representation that:
1. Proper investigation of substitute products, materials, etc. has determined that it is equal or superior in all respects to that specified
 2. Substitute product will provide at least the same warranties for the specified item
 3. Substitute product is compatible with interfacing items
 4. Coordination of the installation of the approved substitution will occur and all changes required in other elements of the work because of the substitution will be carried out.

2.2 UNDERGROUND IRRIGATION CISTERN/WET WELL

- A. Pump station cistern/wet well shall be constructed of precast concrete sections having an inside diameter of 5 feet round x 6.5 feet deep inner chamber depth. Cistern/wet well shall be as shown on the drawings and applicable requirements of the specification.
- B. Strength of the precast concrete to be equal to or exceed 4,000 psi at 28 days and shall be of sufficient strength to withstand a minimum load produced by earth pressure plus hydrostatic pressure at the location site.
- C. Joints between any precast reinforced sections shall be formed so that adjoining sections will fit and seat properly and the gap between sections shall be no more than 3/8 inches.
- D. Cistern/wet well shall be provided with 40-inch circular opening at the location shown in the cover.
- E. Joints between the precast sections shall be made water tight with a preformed plastic sealing compound meeting U.S. Federal Specification SSS-210A. A non-shrink epoxy grout shall be used on the inside and outside of the joints between precast sections.
- F. Cistern/wet well shall be manufactured of pre-cast concrete meeting the following standards:
1. Cement used shall be Portland Cement which conforms to the "Standard Specifications for Portland Cement" of the ASTM Designation C150, latest revision and shall be Type I or II
 2. Sand used shall be clean, hard, strong and durable particles, free of chemicals; coatings or clay and other fine materials and shall meet the requirements of ASTM C33
 3. Stone used shall conform with the above specifications for sand, size shall be ASTM C33 No. 57 (1-inch maximum) and in addition no particle shall be larger in size than three-fourths of the minimum clear spacing between reinforcing bars
 4. Water used shall be potable, fresh, clean and free from detrimental amounts of alkali, oil, acid, organic matter and other deleterious substances
 5. Admixtures used shall conform to ASTM C260 for air entrainment and ASTM C494 for water reducers. Calcium chloride or salts shall not be used
- G. Concrete mix design shall meet the following requirements:
1. Compressive Strength: 4,000 psi @ 28 days

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2. Maximum Slump: 4 inches
 3. Maximum Water/Cement Ratio (by weight): 0.45
 4. Minimum Cement Content: 564 pounds /cubic yard
 5. Air Content: 6%, + 1-1/2%.
 6. Air entraining mixture required
- H. Reinforcing bars shall be deformed type, new billet steel, conforming to ASTM A-615, Grade 60.
- I. Cistern/wet well shall consist of one (1) chamber to achieve required storage volume. Minimum total storage capacity of cistern/wet well shall be 954 gallons, Cistern/wet well shall be placed on a bed of transit-leveled crushed stone of 6 inches thick and a 2-inch sand bedding layer.
- J. Cistern/wet well shall have polypropylene plastic steps integrated with concrete wall for cistern/wet well access (as shown on drawings).
- K. Concrete cistern/wet well shall be manufactured by Oldcastle Precast, Scituate Concrete, Shea Concrete or equal.

2.3 CISTERN/WET WELL SEALS

- A. Cistern/wet well shall utilize link seals for inlet pipe. Holes shall be cored to exact tolerances as necessary to connect pipes and conduits as shown on the drawings. 3-inch well water and 3-inch potable water supply wet well wall penetrations shall be sealed with a properly sized Link-Seals, model LS-300 for 3-inch pipe (6-inch hole).

2.4 PUMP SYSTEM

- A. Main Irrigation Pump
1. Main irrigation pump shall be vertical turbine type capable of providing 185 feet of Total Dynamic Head (TDH) plus station and lift losses at 220 gpm for irrigation system at cistern/wet well pump system discharge. Pump shall start and stop from a pressure transducer and flow meter wired to the cistern/wet well pump system control panel logic and VFD.
 2. Main irrigation pump motor shall not exceed 20 horsepower, operating on 480-volt, 3-phase power from pump control panel.
 3. Entire pump assembly including the bowl assembly, column and shafting shall be of a single United States manufacture. Pump Manufacturer shall have a network of service centers and pump technicians to handle service, repair, and the handling of warranty procedures.
 4. Bowl assemblies including suction case, intermediate bowls and discharge bowls shall be cast iron. Closed impellers shall be of 201 stainless-steel construction statically balanced. Impellers shall have perihedral seals to provide vertical cylindrical and horizontal surface impeller sealing. This seal shall prevent pump shaft stretch from affecting pump performance. Impellers shall be adjusted vertically by means of an adjusting nut located at the top of the driver.
 5. Pump suction case shall incorporate vanes to guide fluid and have a "flare" to minimize shock and entrance losses.
 6. Pump shaft shall be turned, ground and polished stainless steel, 410 AISI alloy with 100,000 psi tensile strength and have a chromium content of not less than 12 percent.

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The pump shaft shall meet the requirements of size, horsepower rating, smoothness and straightness tolerances of AWWA. The shaft is to be supported by bearings above and below each impeller.

7. Suction case bearing, constructed of bronze alloy, shall stabilize the bottom of the pump shaft and provide accurate alignment of impellers. The bearing shall be a minimum of five shaft diameters in length and shall have a bronze collar immediately above to prevent abrasives from entering the bearing.
8. Pump strainer shall be galvanized heavy basket type, corrosive resistant. The open area of the strainer shall not be less than four times the suction bell inlet area.
9. Discharge column pipe shall conform to ASTM A106 standards and shall be A53 Grade B Schedule 40 furnished in interchangeable 10-foot sections. Column end shall be machine faced to provide a butt fit between column sections to maintain alignment throughout pump column assembly. Discharge column piping shall be furnished in interchangeable sections with flanged or threaded couplings. Line shafts shall be polished 416 stainless-steel utilizing non-corrosive sleeves at each bearing. Line shafts shall have steel couplings with left hand threads.
10. Discharge head shall support the entire pump assembly and shall be an open style head. Discharge header shall be constructed with a minimum 60,000 psi tensile strength with a safety factor of 5 to 1 to provide maximum strength. The discharge header shall be flanged with the top diameter matching the diameter of the motor base to evenly distribute the load. Discharge header shall be equipped with a mechanical seal assembly located where the line shaft protrudes through the discharge head. The mechanical seal assembly shall consist of a main housing, shaft sleeve assembly, locking and drive collars. The shaft sleeve shall be machined from 416 stainless steel. The locking and driving collars shall be machined from 7075 aluminum. Integral to the seal housing, a permanently lubricated ball bearing shall be mounted, located out of the pumping media. The mechanical seal shall be resistant to corrosion and abrasives, totally self-lubricating, and rated for no less than 300 PSI. The seal assembly shall require no bypass tubes or related devices to provide cooling or lubrication. (No packing boxes shall be approved.)
11. Pump shall have a relief line to relieve water to prevent the pump from over-heating during shut-off conditions. Discharge from the relief line shall be piped back to the cistern/wet well.
12. For bidding purposes pump shall have a 5.5-foot set from the bottom of the strainer to the top of the pump station skid support. Manufacturer shall coordinate set with Irrigation Consultant before assembling pump shaft.
13. Minimum pump efficiency shall be 82 percent.

B. Motor

1. Motor shall be of U.S. manufacture, 1800 RPM, 3 Phase, 480-volt rated for 60 cycle, 40-degree C ambient, continuous performance. Pump motor shall be squirrel cage induction type vertical hollow shaft motor with rodent screens, conforming to the latest standards of the current American National Standard Association including rating, characteristics, and tests. The pump and motor shall be connected by a bolt-down coupling located in the motor. Motor temperature rise shall conform to NEMA MG-1-12.42 for Class F installations. Motor shall have a thrust bearing of significant rating to carry the weight of rotating parts and the hydraulic thrust of the pump. Bearing should be sized for a minimum life of 5 years.

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2. Motor shall be equipped with a non-reverse ratchet to protect the pump from reverse rotation damage caused by a check valve failure or incorrect electrical phasing.
3. Motor shall be sized so that the maximum possible load developed under pumping conditions specified will not exceed the nameplate horsepower. Pumps designed with the motors running in their service factor at design point will be rejected.
4. Pump station Manufacturer shall provide a 120-volt, single phase space heater of ample size to prevent condensation within the motor. Space heater shall be de-energized when the motor is running.
5. Minimum motor efficiency shall be 94.5 percent.
6. Horsepower shall not exceed 20 horsepower.

C. Jockey Pump

1. Jockey pump shall be electric motor driven; vertical multi-stage centrifugal. Motor shall be mounted directly to the top of the pump. Pump shall be capable of delivering approximately 50 gpm when operating at a total head of 185 feet plus station losses. Pump shall be capable of operating continuously at temperatures of 5 degrees to 250 degrees Fahrenheit. Pump suction/ discharge chamber, impellers, pump shaft, diffuser chamber, outer discharge sleeve and impeller seal ring retainers shall be constructed of 316 stainless steel. Motor shall be constructed of cast iron isolated from the pump fluid by a 316-stainless steel insert. Pump shaft coupling shall be constructed of stainless-steel. Impellers shall be secured directly to the pump shaft by means of a splines shaft arrangement. Intermediate and lower shaft bearings shall be Tungsten Carbide and ceramic. Pump shall be equipped with a high temperature mechanical seal assembly with Tungsten Carbide/Carbon or Tungsten Carbide seal faces mounted in stainless steel seal components.
2. Minimum pump efficiency shall be 60%. Pump shall be as manufactured by Gould's or Grundfos.
3. Jockey pump motor shall be of United States Manufacturer, close-coupled type with rodent screens on ventilating passages. Motor shall no more than 5 HP at 3450 RPM, open drip proof. Radial and thrust bearings of ample capacity to accommodate the hydraulic thrust of the pump shall be incorporated into the motor. Motor shaft shall be of high strength steel. Temperature rise of the motor shall meet NEMA Standard MG-1-12/42 for Class B or Class F insulation. Motor shall be sized so that the maximum possible load developed under pumping conditions specified will not exceed the nameplate horsepower. Pumps with motors running in their service factor will be rejected.
4. Pump to be equipped with a temperature sensor to monitor volute overheating due to loss of suction.
5. Pump motor shall be equipped with a 120-volt space heater in the motor windings to prevent condensation from occurring during non-use times. Heater shall be deactivated while the motor is running.
6. Motor efficiency shall be minimum 82%. Motor shall be manufactured by Baldor or approved equal.

D. Pipe and Fittings

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1. Cistern/wet well pump system piping shall be Schedule 40 painted steel.
 2. Fittings and connections shall be welded, flanged or Victaulic.
 3. Pipe 2-inches and below shall be stainless steel.
- E. Isolation valves
1. Isolation valves shall be installed on individual pump discharges and pressure relief valve within the enclosure. Valves shall have lever handle. Pressure rating shall be 200 psi. Trim shall include stainless steel stem, bronze or nickel coated iron streamlined disc, and full faced resilient seats. Butterfly valves to be as manufactured by Victaulic, Gruvlok, Watts or equal.
- F. Check Valves
1. Check valves to be 150# rated, center pivot, spring loaded, non-slam, silent type cast iron check valve. Sealing surfaces shall have resilient Buna-N-Rubber as manufactured by Valmatic or equal. Pressure loss not to exceed 3 psi at full discharge capacity. Butterfly or swing type check valves shall not be approved for installation.
- G. FLOW METER
1. Pump station shall include a flanged magnetic flow meter having the ability to report the gallons per minute being pumped and the totalized flow volume to the control panel. The magnetic flow meter must be accurate to within plus or minus 0.25% of full scale. Flow meter shall be installed according to Manufacturer's recommendations. Flow meter to be as manufactured by Krohne, Siemens or approved equal.
 2. Flow meter shall be wired to pump station control panel and then Hunter ACC or equal controller with ICD-SEN decoder in series per manufacturers requirements
- H. HIGH VOLTAGE IRRIGATION PUMP CONTROL PANEL
1. Electric control panel shall be located on the cistern/wet well pump system skid with dead front enclosure. Panel shall receive a dedicated 480-volt, 3 phase power circuit.
 2. Control panel as a unit shall be UL-Listed. Units constructed of UL components in lieu of UL Listing shall not be accepted.
 3. Panel shall meet National Electric Code, Longmeadow and Massachusetts codes. In the event of a conflict among the codes, the current National Electric Code shall predominate provided it meets minimum local standards.
 4. Door gasket seals shall be close-cell neoprene sufficient to protect interior components from moisture and dust. Electrical panel doors shall be constructed of 12-gauge steel with locking screws and latches. Internal components of the enclosure shall be mounted on removable back panels. Mounting screws for the components shall not be tapped into the panel enclosure. Panel penetrations must maintain NEMA1 (indoor) integrity. Wiring within and interconnecting the panels and pumps shall be complete. Wiring troughs and cable raceways shall be self-contained within the enclosures and no external cable trays or wiring troughs will be permitted.
 5. Panel shall recognize alarm conditions within the cistern/pump station, including, but not limited to:
 - a. Low Cistern/Wet Well Water Level
 - b. Low Discharge Pressure

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- c. High Discharge Pressure
 - d. Loss of Phase
6. Three-pole, fused main system disconnect shall be mounted in the control panel to isolate completely the electrical system from the incoming power. Disconnect shall conform to NEC requirements. The main disconnect shall have a dead front lockable operating handle on the front or side of the panel
 7. Panel shall include a window to view the drive.
 8. Panel shall include corrosion inhibiting modules.
 9. Jockey (5 hp) starter shall be across the line starter and shall be protected on each power leg by a time delay fuse of the needed amperage and have a reset button. Overload relays shall be ambient-compensating, differential-tripping type installed on each power leg and shall be set to trip at 105% of motor full load current rating. Starter shall be horsepower rated and conform to the standards and recommended practices of NEMA as manufactured by Allen Bradley or approved equal.
 10. Pumps shall have an ON/OFF switch with position indicator mounted on the outside of the control panel.
 11. Pump running light (green) is to be installed in the control panel door. The pump run light is to be illuminated whenever the pump motor is drawing electrical current. This light may be integrated as part of the ON/OFF switch.
 12. The incoming power to the motor (unless included in the starter) shall be protected by a phase-failure/low voltage system dropout relay to de-energize the well pump in case either phase failure, reversal or low voltage condition occurs. The phase-failure cutout condition will remain in effect after power is restored until manually reset.
 13. Panel shall be manufactured by Watertronics or approved equal.
- I. PRESSURE GAUGE
1. Pressure gauges on the station will be of same size and scale, 0 - 200 psi. Gauges shall be glycerin filled with accuracy conforming to ANSI Grade B or greater. Gauges shall be provided minimum on main discharge pipe before and after wye strainer.
- J. VARIABLE FREQUENCY DRIVES
1. Inverter manufacturer shall have a minimum of 5 years' experience in invertors and shall have a minimum 4 years' experience with IGBT transistors used with the drive to produce the output PWM waveform, allowing quiet motor operations.
 2. Adjustable speed inverters shall be a pulse width modulated (PWM) design that has a carrier frequency of 3KHZ or higher so no acoustic noise will be produced onto the motor. The adjustable speed drive shall generate a sine-coded, adjustable voltage/frequency three-phase output for complete speed control of any NEMA B VAV duty squirrel cage induction motor. The adjustable speed drive shall maintain a 120% current overload capability for sixty seconds with automatic stall prevention and boost to prevent a nuisance tripping during load or line side transient conditions. The adjustable speed drive shall maintain a power factor of not less than 0.95 throughout its speed range.

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3. Adjustable speed drives shall have the following basic design:
 - a. Inverter shall consist of a modular assembly consisting of diode rectifier and capacitor assembly, which will first convert, then filter and maintain a fixed DC voltage source from the fixed voltage and frequency input.
 - b. Inverter shall use Insulated Gate Biopolar Transistor (IGBT) with a minimum rating of 1000 VDC on 480 VAC controls to invert the converter fixed DC voltage into a sine-coded pulse width modulated output.
 - c. Control logic shall consist of a single printed circuit board for all horsepower sizes and incorporate an 8 bit or larger, microcomputer central processing unit to control all inverter, converter, base drive and external interface functions.
 - d. Terminal strip for input and output signals must be provided.
 - e. Drive to be mounted in the high voltage control panel.
4. Adjustable speed drives to include, as a minimum, the following design features as standard:
 - a. 3KHz or higher sine-coded, pulse width modulated output
 - b. Eight-bit microcomputer control logic
 - c. Maximum and minimum speed adjustment capability
 - d. Controlled speed range of minimum 20:1
 - e. Overload capability of 120% for 60 seconds, 110% continuous
 - f. Process follower 4-20m ADC, 0-5 VDC, 01-10 VDC or 0-135-ohm resistance input
 - g. Minimum of three selectable output frequency ranges
 - h. Sixteen selectable volts/hertz patterns
 - i. A four-segment digital readout displaying frequency, status, percent current, percent voltage and percent response signal
 - j. Current limiting circuit
 - k. Coast or ramp to stop
 - l. Electronic reversing
 - m. Adjustable acceleration and deceleration
 - n. Fault indicators
 - o. Fault contacts
 - p. Drive shall have an open-collector output signal to indicate when the drive's output is at maximum and minimum speed
5. Adjustable speed drives shall have as a minimum the following protective features:
 - a. Ground fault protection
 - b. Thermal motor overload relay
 - c. Current limit adjustable from 60% - 100%
 - d. Current limited stall prevention during acceleration, deceleration and run conditions
 - e. Automatic restart after momentary power loss or over voltage. The drive shall not restart into faults other than over voltage, under voltage, or over current due to acceleration rate set to fast, because other faults, such as over current to blown transistor or a short circuit on the output, could cause damage to the inverter. No restart into ground fault.
 - f. Start into a rotating motor
 - g. Fault indicators shall indicate the following fault conditions. Faults should be displayed by flashing on the LED display on the front panel of the inverter. When a fault occurs, the drive shall have built in diagnostic functions that assist in determining the cause and source of the fault. The

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drive shall also indicate the level of current and voltage and the frequency at the time of the fault.

1. Over current while running
 2. Over current on output
 3. Internal short circuit
 4. Overload
 5. Over voltage during deceleration
 6. Over voltage due to power surge
 7. Over temperature
 8. Control function error
 9. Ground fault
- h. DC bus discharge indicator. The drive must have a visual indication that is visible with the door closed as to whether hazardous voltage still remains on the DC bus so servicing technicians may avoid exposing themselves to dangerously high voltage.
- i. Current limiting DC bus fuse
- j. Isolated operator controls
- k. Phase-to-phase short circuit protection
- l. High speed current limiting fuses before drive
- m. Contactors in front of drive
11. Adjustable speed drives shall have the following adjustments available:
- a. Acceleration - 0.1 to 300 seconds
 - a. Deceleration - 0.1 to 300 seconds
 - b. Volts/hertz adjustments
 - c. Maximum frequency range
 - d. Minimum frequency (0 to 100% speed)
 - e. Maximum frequency (0 to 100% speed)
 - f. Carrier frequency (3KHZ to 16KHZ)
 - g. Bias and gain adjustment for 4-20mA, 0-5VDC, 0-10VDC follower
12. Adjustable speed drive shall be designed to operate within the following environmental and service conditions:
- a. Ambient service temperature: -10 C to 40 C
 - b. Ambient storage temperature: -20 C to 60 C
 - c. Humidity: non-condensing to 90%
 - d. Altitude to 3300 feet
 - e. Service factor: 1.1
 - f. Input voltage: 380/400/480VAC +/- 10% for 480VAC series
 - g. Input frequency: 50/60 hertz +/- 3%
13. Adjustable speed drives shall be subject to the following parameters and tests:
- a. All integrated circuits (TTL) and all components used for circuit board construction shall be tested to an acceptance criterion of 0.5% AQL (Accepted Quality Level).
 - b. In-circuit testing of all printed circuit boards shall be conducted to insure proper mounting and correct value for all components.
 - c. Final printed circuit board assemblies shall be functionally tested via computerized test equipment where all tests and acceptance criteria are pre-programmed and test results are stored as detailed quality assurance data.

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- d. All fully assembled controls shall be combined-tested for performance and functionality at the manufacturer's factory with fully loaded VAV rated induction motors. The combined test data shall then be analyzed to insure adherence to quality assurance specifications.
- 14. Adjustable speed drives shall be designed and built to the following standards:
 - a. U.L. listed
 - b. NEMA listed
 - c. IEEE 587
- 15. Inverter may be programmed locally from a standard front mounted programming panel or through a serial communication port.
- 16. Variable frequency drives shall have an internal DC link choke to prevent electrical noise from the drive to power source.
- 17. Drives shall be installed for the pump station main pump and the well pump,
- 18. Inverter manufacturers shall have the following available:
 - a. Service engineer
 - b. Training/Service schools
 - c. 24-hour phone service
- 19. Drive manufacturer shall be as manufactured by ABB, Danfoss, Square D or equal.

K. PRESSURE TRANSDUCER

- 1. Pressure transducer shall be a solid-state bonded strain gage type with accuracy of plus/minus 0.25% and constructed of stainless steel. Transducer shall be rated for system discharge pressure as shown on technical data sheet, and shall provide gauge pressure output, rather than an absolute. Pressure transducer shall be constructed of stainless steel. Pressure transducer shall be 4-20mA analog type with 7- 33 VDC supply range
- 2. Pressure transducer shall have a stainless-steel diaphragm and 200 psi burst pressure rated for submersible applications. Transducer shall also have built-in surge protection.
- 3. Transducer shall have a 1/4-inch NPT welded pressure port adapter for installation into water piping. Transducer shall measure pump discharge pressure and have a range of 0-120 psi gauge.
- 4. Pressure transducer shall be compatible with specified pump control panel.
- 5. Pressure transducer shall be as manufactured by IFM or approved equal.

L. SENSOR TERMINATION ENCLOSURE

- 1. Sensor termination enclosure is required for the transducer cable, prior to connection to the variable frequency drive controller. Enclosure shall have desiccant to remove moisture. Sensor Termination Enclosure shall be manufactured by Druck Model STE-110 or approved equal.

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M. FERTIGATION RUN RELAY

1. Manufacturer shall supply an electrical/mechanical interface package to allow for the automatic control of any fertigation and/or injection package provided off the skid. Electrical terminations shall be provided. The interface package shall include minimum the items listed below:
 - a. Manufacturer shall supply within the electrical control enclosure an electronic signal optical isolator. The optical isolator shall allow additional monitoring of the pumping station flow signal. This signal may be utilized for items such as, fertigation controls, irrigation control systems and any additional system that may require a flow signal to operate. Optical isolator shall be as manufactured by Data Industrial, or approved equal.
 - b. Pump station Manufacturer shall include dry contact relays with terminal strip wiring points to allow the activation of fertigation and/or injection pumps. The dry contacts shall close during the automatic operation of any pump, not including pumps utilized for pressure maintenance purposes.

N. WYE STRAINER

1. An iron body flanged wye type strainer having a working pressure of 175 psi shall be part of the pumping station. The screen in the strainer shall be made from AIAI 304 perforated stainless steel reinforced for liquid service, with 1/16-inch screen covered with a 50-mesh cover. The strainer shall have a bolted cover flange machined to securely receive the screen, and the screen shall be positively secured in both the body and cover flange. The strainer should be sized so that "the clean" pressure drop is no more than 3.0 psi as manufactured by Watts Regulator or equal.
2. Provide a 2-inch manual ball valve for wye strainer relief.
3. Discharge from the wye strainer shall be piped 4 inches past to the edge of the pump station enclosure by the Manufacturer through a 2-inch stainless-steel return line securely fastened to prevent movement. Manufacturer shall supply additional pipe and fittings as necessary to bring the discharge to 4-inches outside of the enclosure and covered with a mesh screen that passes water and debris.

O. PRESSURE RELEASE VALVE

1. Pressure relief valve shall be installed downstream of the pumps where indicated on the drawing. The valve is to relieve pressure in excess of system pressure and is to protect the irrigation system against surge on closing.
2. Valve shall seal by means of a corrosion-resistant seat and resilient, rectangular seat disc. These and other parts shall be replaceable in the field; such service and adjustments to be possible without removing the valve from the line. The stem of the valve shall be guided top and bottom by integral bushings. The control valve and its pilot control system shall contain no packing glands or stuffing boxes. The diaphragm shall not be used as a seating surface nor shall pistons be used as an operating medium.
3. Valve shall be operationally and hydrostatically tested prior to shipping and shall carry a one-year warranty against failure due to defects in workmanship or materials.
4. Discharge from the relief valve shall be piped backed into the cistern/wet well through a stainless-steel/steel return line.

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5. Pressure relief valve shall be 1 inch as manufactured by Cla-Val, model 50-01 or equal.

P. WIRE/WIRING

1. Pump power wiring from the control panel to the motors shall be in liquid-tight conduit with copper conductors rated not less than 600 VAC and of proper size to carry the full load amperage of the motors without exceeding 67% capacity of the conductor. Ground control panel as specified in accordance with National Electric Code.
2. Wiring to pressure transducer and flow meter shall be multi-conductor shielded cable suitable for Class II low voltage controls.
3. Wiring within variable frequency drive, pump control panel and components of the pumping system shall be completed by manufacturer at factory.

Q. SEQUENCE OF OPERATION

1. Jockey pump shall start on predetermined drop in pressure for demands less than 50 gallons per minute. Variable speed main pump shall start on flow. Motor frequency shall vary to provide required station demand in gallons per minute at a constant pressure until demand is met or exceeds the pump capacities. Pumps shall retire in the reverse order.
2. Jockey pump shall be used to maintain system pressure at zero flow.
3. Pump station shall be capable of providing flows of 0 to approximately 220 gallons per minute at 80-psi discharge pressure at all times as required by the irrigation system demand.
4. Irrigation pump control panel shall continually monitor centrifugal pump temperature throughout pump operation. When temperature rises above pre-programmed level, control panel shall shut down the centrifugal pump.
5. When final valve closes on scheduled irrigation or hand watering, irrigation control panel shall shut down pump system based on a rise in pressure as sensed by pressure transducer.
6. Pump control panel shall continually monitor cistern/wet well level throughout pump operation.
 - a. When level drops below a pre-programmed maximum wet well level, control panel shall turn on well pump and shut down the well pump when the water level reaches back to the maximum pre-programmed level.
 - b. When level drops below a pre-programmed minimum level control panel shall open potable water fill line modulating butterfly valve then shut the valve off when the water level reaches another maximum preprogrammed level (refer to pumping details).
 - c. When level drops below the low water level hard shut down pre-programmed level, control panel shall shut down the pump station.
7. Potable water supply and well pump flows to meet irrigation system demand shall be settable through the cistern/wet well control panel. Potable water supply flow shall utilize modulating butterfly valve and flow meter. Well pump system flow shall utilize well pump VFD and flow meter.

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R. GROUNDING EQUIPMENT

1. Grounding rod to be 5/8-inch x 10-foot copper clad, UL Listed.
2. Grounding plate to be 4-inch x 96-inch x 0.06-inch copper alloy with integral connection of 25 feet of #6 AWG insulated, solid copper wire, UL Listed conforming to the minimum requirements of Section 250 of the National Electric Code. Connection of the wire to plate shall be performed by the plate Manufacturer.
3. Grounding connections to utilize an exothermic welding process.
4. Grounding wire shall be #6 AWG, solid, bare copper wire.
5. Ground enhancement material shall be PowerSet as manufactured by Loresco or approved equal, 50-pound bags.

S. FOOT VALVE

1. Jockey pump suction piping shall include a 2-inch vertical aluminum foot valve with strainer. Strainer mesh shall be 2-5/8 inches high with 1/4 inch, 5-inch diameter aluminum screen. Open area shall be 17 square inches. Foot valve and strainer shall bolt onto 2-inch threaded suction pipe. Foot valve shall be as manufactured by Sur-Flo Fittings, model SFVV2FP or approved equal.

T. OUTLET PIPE

1. Pump system discharge pipe shall be flange connected to pump station discharge pipe and plain end or mechanical joint connected to irrigation system 6-inch PVC mainline a minimum of 24 inches below grade. Outlet pipe shall include two 90-degree elbows, no 45-degree elbows.

2.5 ELECTRICAL CONDUIT

- A. Electrical conduit shall be installed as required for electrical wiring. Couplings, elbows and other fittings used shall secure a waterproof installation. Elbows shall be sweep ells. 90-degree elbows are not to be used.
- B. Electrical conduit shall be installed for electrical wires for power circuits. Conduit shall be sized as required per NEC.
- C. Conduits shall be watertight.

2.6 WELL PUMP SYSTEM

A. GENERAL

1. Materials to be incorporated in the well pump system shall be new, without flaws or defects and shall conform to all standards set forth in these specifications and as approved by the Owner's Representative.
2. Well pump system to be installed by the Contractor in the existing well.
3. Power supply, three phase, 460-volt, 60 hertz and shall be brought to the well from the pump system control panel by the Contractor.
4. Well pump shall be capable of pumping up to 200 gpm at a head of 35 feet (15 psi) at well discharge at grade.

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5. Well is 8-inch diameter, 710 feet deep. Pump set shall be approximately 665 feet from bottom of motor to grade. 45 feet off bottom of well.

B. CONSTRUCTION

1. Nuts, bolts, washers and fasteners shall be zinc or cadmium plated for corrosion resistance.
2. Well drop pipe shall be constructed from 4-inch Schedule 40 standard weight galvanized steel. No galvanized pipe or fittings shall be allowed except for well drop pipe.
3. Well pump system to connect to wet well with Schedule 80 PVC.
4. Install a 3/4-inch PVC pipe from top of pump to top of well to be able to check water level.

C. PITLESS ADAPTER

1. Pitless adapter unit shall be of steel construction as self-contained, pre-fabricated unit to fit with 8-inch well casing to 4-inch discharge pipe.
2. Pitless adapter unit shall have stainless steel O-ring and spool seat.
3. Pitless adapter unit shall have vented top and neoprene gasket as part of watertight well cap.
4. Pitless adapter unit shall have torque arrestor to prevent spool rotation.
5. Pitless adapter unit shall have integral electrical junction box.
6. Pitless adapter unit shall be as manufactured by MAASS Midwest, Campbell Manufacturing, or approved equal.

B. SUBMERSIBLE PUMP AND MOTOR

1. Pump system shall include multistage turbine type submersible pump capable of pumping 200 gpm at 35 feet (15 psi) as it leaves the well at grade. Pump shall include 100,000 psi stainless steel shaft, type 416 with water lubricated bronze suction, discharge and intermediate bowl bearings. Impellers shall be enclosed cast-bronze balanced and be constructed from C836 bronze and cast-iron bowls shall meet ASTM-A48, class 30. The inlet area shall have a net open area of at least four times the eye area of the impeller. Submersible pump shall be as manufactured by Gould's, model 225H257 or equal.
2. Maximum 25 Hp submersible motor shall meet NEMA standards and operate within the nameplate horsepower for any point on the operating curve. The motor shall be of corrosion resistant construction, 316 stainless steel shell, splines stainless steel shaft, cast iron end bells, hermetically sealed windings, Kingsbury-type thrust bearings, pressure equalizing diaphragm, removable water-bloc lead connector and UL recognized.
3. Contractor shall use a properly installed submersible splice kit to connect to the submersible motor. The power cable shall be UL Listed, type TW rated for 600 volts with ground wire.
4. Submersible pump shall be installed approximately 655 feet below grade.

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C. VFD DRIVE

1. Well pump system shall include a VFD drive. See above for specifications.

D. CHECK VALVE

1. Check valve to be flanged, 150# rated, center pivot, spring loaded, non-slam, silent type cast iron check valve in addition to any included on the pump as indicated on the drawings. Sealing surfaces shall have resilient Buna-N-Rubber as manufactured by Val-Matic or approved equal. Pressure loss is not to exceed 3 psi at full discharge capacity. Butterfly or ball type check valves shall not be approved for installation.
2. Submersible pump shall have a check valve mounted on the discharge pipe in addition to any in the pump itself.

E. DISCONNECT

1. A three pole, knife or approved type disconnect shall be mounted in the well control panel to completely isolate the electrical system from the incoming power. The disconnect shall conform to NEC requirements. The well disconnect shall have an operating handle on the front or side of the panel. Rotary handles shall include actuator supports to enhance alignment.

F. WIRING

1. Well pump system wiring from the control panel to the motor shall be in conduit with copper conductors rated not less than 600 VAC and of proper size to carry the full load amperage of the motors without exceeding 70% capacity of the conductor. A grounding cable sized to current National Electric Code requirements shall be included in the liquid-tight conduit. There shall be no splices between the well pump system motor and the motor VFD connection at the pump control panel.

G. ISOLATION VALVE

1. Isolation valve shall be installed on well discharge pipe. Valve shall have lever handle. Pressure rating shall be 200 psi. Trim shall include stainless steel stem, bronze or nickel coated iron streamlined disc, and full faced resilient seats. Butterfly valves to be as manufactured by Victaulic, Gruvlok, Watts or equal.

H. FLOW METER

1. Flow sensor for well pump shall be 3-inch, with 150 psi pressure rating. Sensor shall have flow range of 6 to 300 gpm and be installed in a PVC saddle tee. Output shall be two wire standard pulse. Flow sensor shall be as manufactured by Creative Sensor Technologies, model CSI-FS1-S30-001 w/saddle.
2. Well pump system flow sensor shall be installed on 4-inch PVC pipe where indicated on the drawings in standard valve box between the well and the cistern. Install pump system flow meter per manufacturers requirements. Wire flow meter to pump control panel per manufacturers requirements.

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I. SEQUENCE OF OPERATION

1. Submersible well pump shall start and stop manually based on level sensor in the wet well.
2. Well pump system shall be capable of providing a flow of minimum 0-200 gallons per minute at 15 psi discharge pressure at grade through the use of the VFD drive and flow meter.
3. Well pump flow shall vary based on the flow requirements set in the cistern/wet well control panel.

J. OUTLET PIPE

1. Outlet pipe shall be 4-inch (discharge) PVC pipe as specified to cistern/wet well a minimum of 24 inches below grade.

2.7 FERTIGATION SYSTEM

- A. System shall include a complete commercial grade fertigation system as manufactured by EZ-FLO Fertilizing Systems or approved equal.
- B. System shall include but not limited to:
 1. Two (2) 6-inch x 1-inch SVF venturi saddle injectors for 6-inch mainline
 2. One (1) 25-gallon EZ025-HC PVC fertilizer tank (36-inch x 19-inch x 23-inch)
 3. One (1) 36-inch x 24-inch x 24-inch valve box
 4. Two (2) 10-inch round valve boxes for injectors
 5. Pressure relief valve
 6. Vacuum Breaker
 7. Required tubing and connectors
- C. Contact EZ-FLO for application specifics prior to ordering materials.

2.8 WIRES AND CABLES

- A. Cable from the pump station control panel to potable water supply and well pump system flow sensors shall be jacketed, four conductor, two pair cable. The cable shall be suitable for direct burial in the earth and also may be installed in ducts or conduits. Conductors shall be high density insulated tin coated copper conductors. Conductors shall have a 0.00235-inch aluminum/mylar shield helically applied and a #20 AWG drain wire to drain off electrical, magnetic or RF interference. The cable shall be rated 600 volts. The four conductors shall be seven strand, #18 AWG, 0.015 high density PE insulation wall. The two pair shall be color coded red/black and blue/orange and shall be soft annealed tin coated copper conforming to ASTM B-33. Insulation shall be high density polyethylene conforming to ICEA S-56-434. Outer jacket shall be 0.045-inch polyethylene conforming to ICEA S-61-402. The communication type cable shall be marked on the jacket as follows: "2 Pr #18 AWG Shld D/B Paige P7171D". Wire shall be as manufactured by Paige Electric, P7171D or approved equal.

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- B. Power cables from pump control panel to well pump shall be "Tray Cable", #6/3 with #10 ground. Cable shall be UL listed, type TC, 600 volts, VW-1 rated, 90 degree centigrade dry, 75 degree centigrade wet. Cable shall be high dielectric PVC insulation with a nylon insulation armor and overall PVC jacket. Cable shall consist of a single jacketed four wire combination. Four individual jacketed conductors shall not be allowed. Wire shall be as manufactured by Paige Electric, P7267D or equal.
- C. Communication cable from pump station control panel to irrigation controller shall be 2-wire communication cable as specified for the irrigation system with flow sensor decoder.
- D. Modulating butterfly valve wire shall be UL Listed, 14/2 rated for direct burial
- E. Wire to heaters from pump control panel shall be UL listed, #10/2 w/ground.

2.9 CRUSHED STONE BASE

- A. Concrete pad and wet well shall be installed on a compacted dense graded, minimum 6-inch-thick, 3/4-inch crushed stone base.

2.10 PUMP STATION ENCLOSURE

- A. Skid/enclosure shall be marine grade aluminum, with stainless steel base, approximately 89 inches long x 60 inches high x 56 inches wide. Enclosure shall house all cistern/wet well pump system equipment including pump, check valve, PRV, wye strainer, VFD drives, disconnect, water meter, backflow preventer, etc.
- B. Enclosure shall be locking with access from the front side.
- C. Enclosure shall be securely lagged to concrete pad at each corner.
- D. Enclosure color shall be determined by the Owner's Representative

PART 3 – EXECUTION

3.1 GENERAL

- A. Examine documents applying to the cistern/wet well pump system installation noting any discrepancies and bringing the same to the attention of the Owner's Representative for timely resolution.
- B. Work indicated on drawing shall be provided whether or not specifically mentioned in the specifications and vice-versa.
- C. Make field measurements necessary for the work noting the relationship of the cistern/wet well pump system work to the other trades. Coordinate with other trades (landscaping and other site work trades). Major changes shall be reviewed with the Owner's Representative prior to proceeding.
- D. Protect existing fences, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the work of another trade shall be reported at once.

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3.2 CISTERN/WET WELL INSTALLATION

- A. Excavation for installation of the cistern/wet well shall be performed by mechanical equipment of the proper size. Care shall be taken to minimize the diameter of the excavation while maintaining safe and clean working conditions, as outlined by OSHA standards.
- B. Backfill around the cistern/wet well shall be new, clean, compacted material provided by the Contractor. Contractor shall be responsible for settling of the enclosure due to improper compaction of the new material around the cistern.
- C. Excess excavated material shall be disposed of by the Contractor on site in a safe and legal manner.

3.3 SITE PREPARATION

- A. Contractor shall grade and firmly compact the cistern/wet well area for installation of crushed stone, using new material provided by the Contractor. Contractor shall provide compaction testing to assure 98% proctor density in accordance with ASTM D1557. Compaction testing results shall be approved by the Engineer. Contractor shall be responsible for settling due to improper compaction.

3.4 MAIN PUMP SYSTEM INSTALLATION

- A. Site work to be complete before arrival of pump station from manufacturer.
- B. Following installation of cistern, new pump station shall be installed. Coordinate installation schedule with the Owner's Representative.
- C. Pump station shall be securely lagged to cistern/wet well using four (4) 5/8-inch stainless steel bolts 8 inches long and four (4) 4-inch x 8 inch, 1/4-inch-thick steel plates painted same color as pump station enclosure.
- D. Connect discharge piping without strain to flanged outlet of pump station. Pump station shall not be used as thrust block. 6-inch PVC irrigation piping shall be connected to outlet of pump station using a mechanical connection or gasketed connection.
- E. Release valve discharge will be piped in painted steel or stainless-steel pipe back into the wet well.
- F. Wye strainer discharge will be piped in painted steel or stainless-steel to the outside edge of the enclosure and terminated with a screen flanged so water can pass through it to atmosphere.
- G. Connect piping and electrical connections associated with cistern/wet well pump system installation as specified.
- H. Procure, coordinate and pay for crane, rigging equipment and other equipment required for safe and timely offload, set and installation of cistern/wet well pump system and its appurtenances on predetermined schedule with the Owner's Representative.
- I. Whether or not specified, provide complete installation of cistern/wet well pump system including electrical work.

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3.5 FERTIGATION SYSTEM INSTALLATION

- A. Install fertigation system approximately where indicated on the drawings as approved by the Owner's Representative.
- B. Install system complete in place per manufacturer's written installation instructions and the details.

3.6 WELL PUMP SYSTEM INSTALLATION

- A. New pump shall be installed in existing well per AWWA guidelines
- B. Contractor shall be responsible for installing pipe and wire associated with the well pump system installations as specified. Discharge piping shall include check valve and isolation valves connected without strain to well pump system discharge pipe as indicated on the drawings.
- C. Contractor shall be responsible for wiring the well pump to the well pump VFD in the pump station control panel.
- D. Contractor shall be responsible for procuring, coordinating and paying for equipment required for the safe and timely installation of the well pump and its appurtenances on a predetermined schedule with the Owners Representative.
- E. Well discharge piping shall be connected without strain to 4-inch cistern fill pipe by the Contractor.
- F. Contractor shall be responsible for installing all piping associated with the well pump system installation as specified.

3.7 GROUNDING INSTALLATION

- A. Pump station controls shall include factory-installed and factory-recommended lightning protection and shall be connected to a 5/8-inch diameter x 10-foot long copper clad grounding rod with minimum #6 AWG, solid, insulated copper wire and 4-inch x 96-inch x 0.0625-inch copper grounding plate as outlined below. Minimum 20-foot separation between rod and plate. Minimum 12-foot separation between control panel and ground rod. Connection to rod shall be with exothermic connector as specified. Connection to plate shall be performed by the plate manufacturer with 25-feet of insulated copper wire already attached. Grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4-inch drainage pipe. Plate shall be installed in ground enhancement material. Plate shall be covered with 4-inch plastic grated cover with detection and minimum 36 inches of 4-inch drainage pipe. Ground rod and plate shall be UL listed.
- B. Control panel shall be grounded to one rod and one plate. The 10-foot rod shall be installed penetrating into the soil to its full length. Plate shall be installed at a 36-inch depth with 50 lbs. of PowerSet or equal ground enhancement material spread evenly below the plate and 50 lbs. spread evenly above the plate in accordance with manufacturer's requirements. The grounding electrodes shall be installed at least 10 feet from wires connected to the control panel.

3.8 CISTERN/WET WELL PUMP SYSTEM TESTS

- A. TECHNICAL START-UP OF THE SYSTEM – When pump control panel and electrical connections have been completed for the cistern/wet well pump system and well pump, the contractor shall provide the following:

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1. Start-up the cistern/wet well pump system and pressurize irrigation system.
2. Conduct training to familiarize the Owner's Representative with the system operation, maintenance and adjustments.
3. Adjust valves and pump pressures and flows for optimum performance of the irrigation system and prevent frequent on/off cycling of the pumps.
4. Adjust control panel for optimum cistern/wet well pump system performance and efficiency.
5. Adjust cistern level controls for optimum well pump and potable water feed performance and efficiency for the flows indicated or as dictated by the Owner's Representative.
6. Monitor a partial cycle of the irrigation system if possible and authorized by the Owner's Representative to identify any problems with the cistern/wet well pump system.

B. SYSTEM TESTING

1. Cistern/wet well pump system, well pump shall operate without undue vibration throughout the range of operating conditions. The cistern/wet well pump system and well pump as well as the potable water feed shall be given a running test of normal start and stop operations. During such tests, the pumps shall demonstrate their ability to operate without undue vibration and shall demonstrate without question its general fitness for service. Defects shall be corrected and adjustments made without expense to the Town of Longmeadow. Tests shall be repeated until satisfactory results are obtained.
2. Cistern/wet well pump system and the well pump shall show that the safeties incorporated in the systems are also functioning.
3. Contactor/manufacture shall test the logic between the cistern/wet well pump system, well pump and potable water feed for proper on/off level points for each water supply system.
4. Manufacturer and Contractor shall notify the Owner's Representative in advance of final test.
5. Test lines in cistern/wet well pump system under pressure for leaks. Repair leaks and re-test.
6. Furnish necessary equipment to perform tests.
7. Review all Maintenance and Operating Manuals section-by-section with the Owner's Representative and turn them over.

3.9 ACCEPTANCE AND OPERATION BY OWNER

- A. Upon completion of the work and acceptance by the Town of Longmeadow, the Contractor shall be responsible for the training of the Owner's Representative(s) in the operation of the cistern/wet well pump system (provide minimum 7 days' written notice in advance of test). Furnish, in addition to the Operating and Maintenance Manuals, copies of available specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the cistern/wet well pump system. Guarantee parts and labor under this specification for a minimum period of one (1) year from date of acceptance.

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- B. Conditions for acceptability of work for start of maintenance by City of Longmeadow issued by Owner's Representative shall include but not be limited to:

1. Irrigation cistern/wet well pump system complete and in place.
2. Well pump and associated equipment complete and in place.
3. Punch list items complete and approved by Owner's Representative.
4. Operating and Maintenance Manuals approved.

3.10 CLEAN UP

- A. Upon completion of installation, remove leftover materials and equipment from the site in a safe and legal manner.
- B. Remove debris resulting from the cistern/wet well pump system work.

32 31 14 – COLOR CHAIN LINK FENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide all equipment, materials, and appurtenances to do all work necessary to construct the color chain link fence as indicated on the drawings and as specified. Work includes but is not limited to the following:
 - 1. Color fence framing system
 - 2. Color chain link fence fabric

1.3 RELATED SECTIONS

- A. 31 30 00 – Earthwork
- B. 32 30 16 – Cast in Place Concrete

1.4 QUALITY ASSURANCE

- A. Chain link fencing manufactured in accordance with the requirements of the CLFMI Manual. Manufacturer of the fencing system must be a CLFMI member.

1.5 SUBMITTALS

- A. Product Data: Submit catalog cuts and manufacturer's detail specifications for all materials and equipment to be incorporated into the work.
- B. Warranty: Color chain link fence systems supplied with minimum fifteen (15) year factory warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Framework for color chain link fence systems shall conform to Ameristar® PermaCoat® PC-40™ Fence Pipe (industrial weight), as manufactured by Ameristar Fence Products in Tulsa, Oklahoma or approved equal. Qualified manufacturers shall have a minimum of five years of experience manufacturing PVC coated chain link fencing.

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B. Obtain chain link fences including accessories, fittings, and fastenings, from a single source.

C. Manufacturer:

1. Ameristar Fence Products

Phone: (800) 321-8724 Fax: (877) 926-3747

Or approved equal.

2.2 MATERIAL – STEEL FRAMEWORK

A. The steel material used to manufacture fence pipe shall be zinc-coated steel strip, galvanized by the hot-dip process conforming to the criteria of ASTM A653 and the general requirements of ASTM A924.

B. The zinc used in the galvanizing process shall conform to ASTM B6. Weight of zinc shall be determined using the test method described in ASTM A90 and shall conform to the weight range allowance for ASTM A653, Designation G-210.

C. The framework shall be manufactured in accordance with commercial standards to meet the strength (50,000 psi minimum yield strength) and coating requirements of the following standards: 1.) ASTM F1043, Group IC, Electrical Resistance Welded Round Steel Pipe, heavy industrial weight. 2.) M181, Type I, Grade 2, Electrical Resistance Welded Steel Pipe. 3.) RR-F-191/3, Class 1, Grade B, Electrical Resistance Welded Steel Pipe.

D. The exterior surface of the electrical resistance weld shall be recoated with the same type of material and thickness as the basic zinc coating.

E. The manufactured framework shall be subjected to a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.

F. The material used for the base coat shall be a zinc-rich (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be (2) mils. The material used for the finish coat shall be a thermosetting "no-mar" TGIC polyester powder; the minimum thickness of the finish coat shall be (2) mils. The stratification coated pipe shall demonstrate the ability to endure a salt-spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours. Additionally, the coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the cross-hatch test, Method B, in ASTM D3359. The polyester finish coat shall not crack, blister or split under normal use.

G. The color of all frame work is as indicated on the plan sheets and shall be in accordance with ASTM F934.

H. The strength of fence pipe shall conform to the requirements of ASTM F1043; the minimum weight shall not be less than 90% of the nominal weight. The strength of line, end, corner and pull posts shall be determined by the use of 4' or 6' cantilevered beam test. An alternative method of determining pipe strength is by the calculation of bending moment. Conformance with this specification can be demonstrated by measuring the yield strength of a randomly selected piece of pipe from each lot and calculating the section modulus. The yield strength shall be determined according to the methods described in ASTM E8. For materials under this

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specification, the 0.2 offset method shall be used in determining yield strength. Terminal posts, line posts and top/bottom rails shall be precut to specified lengths.

2.3 MATERIAL – FENCE FABRIC

- A. The material for chain link fence fabric shall be manufactured from galvanized steel wire. The weight of zinc shall meet the requirements of ASTM F668. Galvanized wire shall be PVC-coated to meet the requirements of ASTM F668. The class of the fence fabric shall be Class 2B – Fused and Bonded. Fabric shall be 9 gauge core 1-3/4" diamond mesh.
- B. Selvage: Top edge knuckled and bottom edge knuckled.
- C. Color: The coating color for the fence fabric is as indicated on the plan sheets. Reference ASTM F688 and ASTM F934.
- D. Wire Size: The size of the steel wire core shall be as indicated on the plan sheets. The finished size of the coated wire is as indicated on the plan sheets.
- E. Height and Mesh Size: The fabric height shall be as indicated on the plan sheets with a mesh size as is indicated on the plan sheets.

2.4 MATERIAL – FENCE FITTINGS

- A. The material for fence fittings shall be manufactured to meet the requirements of ASTM F626. The coating for all fittings shall be the same PermaCoat color coating system required for the framework; the color for all fittings shall be as indicated on the plan sheets in accordance with ASTM F934.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify areas to receive fencing are completed to final grades and elevations.
- B. Ensure property lines and legal boundaries of work are clearly established.

3.2 CHAIN LINK FENCE FRAMING INSTALLATION

- A. Install chain link fence in accordance with ASTM F567.
- B. Space line posts uniformly and as shown on the plans and details.
- C. Concrete set terminal and line posts: Drill holes in firm, undisturbed or compacted soil. Holes should have a diameter 4 times greater than outside of post, and depths approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, to accommodate the frost depth of 48", and for posts with heavy lateral loads. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.

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- D. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.
- E. Bracing: Install horizontal pipe brace at mid-height for fences 6' (1830 mm) and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Install braces and adjust truss rod, ensuring posts remain plumb.
- F. Tension wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties or clips. Secure tension wire to fabric with 12-1/2 gauge 0.0985" hog rings 24" on center (609.6 mm).
- G. Top rail: Install lengths as detailed and connect joints with sleeves for rigid connections for expansion/contraction.
- H. Rails: Center rails are to be installed when fence fabric is 12' (3658 mm) or higher or when shown on drawings. Bottom rails are to be installed when shown on drawings.

3.3 CHAIN LINK FABRIC INSTALLATION

- A. Fabric: Install fabric on court side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2" between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15" on center and to rails, braces, and tension wire at 24" on center.
- B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands spaced maximum of 15" on center.

3.4 ACCESSORIES

- A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.
- B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.5 CLEANING

- A. Clean up debris and unused material and remove from the site.

END OF SECTION 32 31 14

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**SECTION 32 84 00
IRRIGATION SYSTEM**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Include the CONTRACT GENERAL CONDITIONS and DRAWINGS as part of this Section.
- B. Coordinate Work of this Section with other underground utilities.

1.2 WORK TO BE DONE

- A. Work to be done includes furnishing all labor, materials, equipment and services required to complete all irrigation Work indicated on the drawings, as specified herein, or both.
- B. The irrigation system shown on the drawings and described within these specifications represents a single controller, athletic field irrigation system supplied from an existing 2-inch potable water supply.
- C. The electrical point of connection for the controller shall be the existing 120-volt supply to the existing controller installed in the electrical enclosure.
- D. The drawings and specifications must be interpreted and are intended to complement each other. Furnish and install all parts, which may be required by the drawings and omitted by the specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, refer the matter to the Owner's Representative for decision, and his/her interpretation shall be final, conclusive and binding.
- E. All necessary changes to the drawings to avoid any obstacles shall be made by the Contractor when approved by the Owner's Representative.
- F. Pulling, trench excavation, backfilling, bedding materials and renovation, together with the testing of the completed installation shall be included in this Work.
- G. Work shall be constructed and finished in every respect in a good, Workmanlike and substantial manner, to the full intent and meaning of the drawings and specifications. All parts necessary for the proper and complete execution of the Work, whether the same may have been specifically mentioned or not, or indicated on the drawings, shall be done or furnished in a manner corresponding with the rest of the Work as if the same were specifically herein described.

1.3 ORDINANCES, PERMITS AND FEES

- A. Work under this Section shall comply with all ordinances and regulations of authorities having jurisdiction.
- B. Obtain and pay for any and all permits, tests and certifications required for the execution of Work under this Section.

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- C. Furnish copies of Permits, Certifications and Approval Notices to the Owner's Representative prior to requesting payment.

1.4 QUALITY ASSURANCE

- A. Installer: A firm, which has at least five (5) years' experience in Work of the type (athletic fields) and size, required by this Section and which is acceptable to the Owner's Representative.
- B. References: Supply five references for irrigation Work of this type and size with their bid including names and phone numbers of contact person(s).
- C. Applicable requirements of accepted standards and codes shall apply to the Work of this Section and shall be so labeled or listed:
 - 1. American Society for Testing & Materials (ASTM)
 - a. ASTM: D1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - b. ASTM: D1785 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and CI200.
 - c. ASTM: D2464 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - d. ASTM: D2466 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - e. ASTM: D2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - f. ASTM: B43-98 Brass pipe.
 - g. ASTM: F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - h. American Water Works Association (AWWA)
 - 2. National Standard Plumbing Code (NSPC)
 - 3. National Electric Code (NEC)
 - 4. Underwriters Laboratories, Inc. (UL)
 - 5. American Society of Agricultural and Biological Engineers (ASABE)
 - 6. Occupational Safety and Health Regulations (OSHA)
 - 7. American Society of Irrigation Consultants (ASIC)

1.5 TESTS

- A. Observation: Owner's Representative will be on site to insure the system is being installed according to the specifications and drawings.
- B. Coverage Test: After completion of each system, test the operation of the system. Demonstrate to the Owner's Representative that all irrigated areas are being adequately covered. Furnish

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and install materials required to correct inadequacies of coverage or where the system has been willfully installed when it is obviously inadequate or inappropriate.

- C. Pressure Test: Contractor will be required to provide documentation that they have completed a pressure test on the mainline piping system. The test must be completed on two (2) different days. The system shall be brought up to operating pressure and the system isolation valve then closed for a period of 12 hours. The pressure loss may not exceed 4 psi. Acceptance of the system will be approved when these parameters are achieved.

1.6 SUBMITTALS

- A. Provide copies of product specification sheets on all proposed equipment to be installed to the Owner's Representative for approval prior to the start of Work, in accordance with the parameters of Division-1. Work on the irrigation system may not commence until product sheets are submitted and approved. Submittals shall be marked up to show proper nozzles, sizes, flows, etc. Equipment to be included:

1. Sprinklers
2. Valves: Manual and Automatic
3. Controller and Enclosure
4. Valve Boxes
5. Pipe and Fittings
6. Wire, Connectors and Conduits
7. Quick Coupling Valves
8. Weather Sensor
9. Grounding Equipment
10. Identification Tags
11. Miscellaneous Equipment

1.7 RECORD DRAWINGS

- A. Provide and keep up-to-date a complete redlined record set of drawings of the irrigation system as the project proceeds. Drawings shall be corrected daily, showing every change from the original drawings and specifications. Record drawings shall specify and exactly locate valve, piping, wiring and controller. Each valve box location to be referenced by distance from a minimum of two permanent locations. All wire routing, wire size and splices shall be indicated. Copies of the original bid documents may not be used as record drawings. This redlined record set of drawings shall be kept at job site and shall be used only as a record set.
- B. This redlined set of documents shall also serve as Work progress sheets and shall be the basis for measurement and payment for Work completed. This record set of drawings shall be available at all times for observation and shall be kept in a location designated by the Owner's Representative. Should this record set of drawings not be available for review or not be up-to-date at the time of the observation, it will be assumed no Work has been completed. Provide

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copies of the redlined record set of drawings for the Owner's Representative review on a weekly basis.

- C. Contractor shall be responsible for numbering sprinkler zones as they relate to the station programming, on the as-built upon completion of each week's irrigation system Work. In the event field notes, plan measurements, etc. are deemed incorrect at any time, it will be the responsibility of the Contractor to make all corrections.
- D. Furnish to the Owner's Representative final as-built plans to scale on reproducible bond paper of the following:
 - 1. Mechanical plan, showing precise location of valves, and quick couplers, pipe routing, pipe size and mainline directional fittings.
 - 2. Control plan showing the controller, wire routing, wire splices and zone number as it relates to the programming the controller.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Store and handle all materials in compliance with manufacturer instructions and recommendations. Protect from all possible damage. Minimize on-site storage.

1.9 GUARANTEE

- A. Obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.
- B. In addition to the manufacturers guarantees warrant the irrigation system Work, both parts and labor until acceptance of the system by Owner's Representative, including winterization and spring start-up until end of warranty period.
- C. Should any problems develop within the warranty period because of inferior or faulty materials or workmanship, they shall be corrected to the satisfaction of the Owner's Representative at no additional expense to the Owner.
- D. Contractor shall be responsible for managing warranty issues.
- E. A written warranty showing date of completion and period of warranty shall be supplied upon completion of the project.

1.10 COORDINATION

- A. At all times coordinate Work closely with the Owner's Representative to avoid misunderstandings and to efficiently bring the project to completion. Owner's Representative shall be notified as to the start of Work, progression and completion, as well as any changes to the infrastructure drawings before the change is made. Coordinate Work with that of any sub-contractors.
- B. Be responsible for and pay for damage to other Work caused during irrigation system installation by workmen or sub-contractors. Repairing of such damage shall be done by the Contractor who installed the Work, as directed by the Owner's Representative.

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1.11 PROCEDURE

- A. Provide and install temporary support, adequate protection and maintenance of all structures, drains, sewers, curbs, walls, roadways and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed or reconstructed as directed by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the system. All material overages not installed at the completion of the installation are the property of the Contractor and shall be removed from the site.
- B. Provide manufacturers' products called for "or approved equal" in which case submit a substitution to the Owner's Representative for approval. Certain manufacturer's names and model numbers are used throughout these specifications to denote a standard. Alternate manufacturer's products are acceptable when products of equal or better quality and performance are submitted. Alternative products must be equal to, or better, to qualify as an "or approved equal" product.

2.2 IRRIGATION PIPE

- A. Pipes shall bear the following markings: Manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and date of extrusion.
- B. Pipe in sizes 2-1/2 inches and below, shall be PVC, Class 200, SDR 21, Type 1120, Solvent-Weld PVC, conforming to ASTM No. D2241 as manufactured by Ipex, JM Eagle or approved equal.
- C. PVC sleeving pipe shall be minimum Class 160, Gasketed Joint PVC as manufactured by National, Ipex or JM Eagle.

2.3 IRRIGATION FITTINGS

- A. Fittings for PVC pipe, 2-1/2 inch and smaller in size, shall be Schedule 40 solvent weld joint fittings as manufactured by Dura, Lasco or Spears.
- B. For lateral tap lines, PVC tap tees with schedule 80 threaded nipples and elbows shall be used. Saddles: strap, bolt down, snap shall not be approved for installation.
- C. All threaded PVC connections shall be made using Schedule 80 toe nipples and Schedule 40 couplers or socket fittings (see details). Schedule 40 threaded fittings will not be approved for installation.
- D. Fittings shall bear manufacturer's name or trademark, material designation, size, and applicable IPS. schedule.

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- E. PVC solvent shall be NSF approved, for Type I and Type II PVC pipe, and Schedule 40 and 80 fittings. Cement is to meet ASTM D2564 and FF493 for potable water pipes. PVC solvent cement shall be Rectorseal Gold, IPS Weld-ON, or Oatey and shall be used in conjunction with the appropriate primer. Cements not requiring primer will not be approved. Primers and cements shall be intended for new installations, not repairs. Glue shall be medium, not fast set (no wet and dry or hot). Primer shall be NSF approved, and formulated for PVC and CPVC pipe applications. Primer is to meet ASTM F 656. Clear primers are not allowed. Primer shall be Rectorseal, IPS Weld-On or Oatey for PVC and CPVC. Primers and cement shall include their expiration date, and will be used before that date. Primers and solvents shall be stored in an area with a constant temperature over 45 degrees and less than 100 degrees Fahrenheit.
- F. All nipples to be schedule 80 PVC.

2.4 ELECTRICAL WIRE CONDUIT

- A. Polyvinyl Chloride (PVC) conduits and sweeps shall be heavy wall, rigid Schedule 40 non-metallic utility conduits and sweeps, sized as indicated on the details and shall meet in all respects the requirements of UL 651, standards for Schedule 40 PVC conduits. Sweep ells shall be standard electrical type PVC schedule 40 long sweep elbows.
- B. Conduit and sweeps shall be rated for direct burial, 90 degrees Centigrade. Conduit for wiring beneath non-soil areas shall be PVC, SCH-40 conduit with solvent-weld joints, as manufactured by Cresline, Carlon or JMM.
- C. All conduit terminations shall include a properly sized standard insulating bushing (grommet), including controller sweep terminations as required by NEC.

2.5 LARGE ROTARY SPRINKLERS

- A. Large rotary sprinklers shall be gear-driven, rotary type with drain check valve and stainless steel riser designed for in-ground installation. The nozzle assembly shall elevate three inches when in operation and retraction shall be achieved by a stainless steel spring. Check valve shall be capable of holding up to 10 feet of elevation. Sprinkler shall be capable of covering a 56-foot radius at a flow rate of 13.4 gpm at 50 pounds per square inch of pressure.
- B. All sprinkler parts shall be removable through the top of the unit by removing a heavy-duty threaded cap. The sprinkler shall have a one- inch (1") IPS water connection on the bottom of the sprinkler.
- C. Sprinklers shall be manufactured by Hunter Industries model I25-04-SS (#15) or approved equal.

2.6 ELECTRIC CONTROL VALVES

- A. Electric control valves shall be 1-1/2 inch or 2-inch remote control, diaphragm type, fiberglass or reinforced nylon body plastic valves with manual flow control, manual bleed screw and 200 psi pressure rating. The valve shall have a self-cleaning stainless steel screen designed for use in dirty water applications.
- B. Valves shall be manufactured by Hunter Industries model ICV, Rain Bird model PEB or approved equal.

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2.7 IDENTIFICATION TAGS

- A. All wire at electric valves and any splices shall have ID tags attached. ID tags shall be yellow, print area 2-inch x 1.25 inch.
- B. Electric valves shall be equipped with identification tags indicating the sprinkler zone entered into controller. Lettering shall include letters and numbers as required.
- C. Ink shall be permanent.
- D. Tags shall be as manufactured by Paige Electric, Wire Marking Tags or approved equal.

2.8 ISOLATION VALVES

- A. Lateral isolation valves shall be gate type of bronze construction, US Manufacturer, 200 WOG with bronze cross handle and 200 psi rating. Gate valves to be as manufactured by Nibco, model T-113-K, Apollo 102T or approved equal.

2.9 VALVE BOXES

- A. Valve boxes shall be manufactured from unformed resin with a tensile strength of 3,100-5,500 psi conforming to ASTM D638. Boxes shall be black or green in color. Color of covers shall be as specified.
- B. Valve box lids shall have a 10-year manufacturer's warranty.
- C. Detection for valve boxes shall consist minimally of a #10 stainless steel washer and screw installed on the underside of the valve box cover.
- D. Bolt down covers for electric valves and splice boxes shall be secured with one hexagon bolt.
- E. Valve boxes for electric control valves and isolation shall be standard or jumbo valve boxes with green T-top lids, metal detection and bolt down covers. Valve boxes shall be as manufactured by Highline Products or approved equal.
- F. Valve boxes for individual lateral isolation valves shall be 10-inch round valve boxes with green, T-top lids and metal detection. Valve boxes shall be manufactured by Highline Products or approved equal.
- G. Valve boxes for wire splices shall be 10-inch round valve boxes with gray lids, metal detection and bolt down covers. All splices shall be in separate valve boxes and not included with valves or other irrigation equipment. Valve boxes for wire splices shall be manufactured by Highline Products or approved equal.
- H. Valve box extensions shall be provided and installed as required for proper box depth. Valve box extensions shall be made by the same manufacturer as the valve box.
- I. Covers for ground rods and plates shall be 4 inch, green grated covers with detection consisting of a #10 stainless steel washer and screw installed on the bottom side of the cover. Cover shall be installed on a 6 inch or 30-inch length of 4-inch perforated drainage piping as manufactured by ADS and indicated on the details.

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2.10 CONTROLLER

- A. Controller shall be electronic in construction with capability of up to 12 hour run times per zone in increments of 1 or 10 minutes. Controller to have minimum four independent programs, auto/off switch and be capable of manual, semi-automatic and automatic operation. Controller shall have water budgeting feature, cycle and soak feature, sensor input terminal, test program, sensor bypass, programmable rain delay, non-volatile memory, delay between stations, global seasonal adjustment, monthly seasonal adjustment, maximum 9-hour delay between stations, sensor programmable by zone, total runtime calculator, no water window, event day off programming, two sensor inputs, locking, weather resistant cabinet and internal transformer. Terminal strip connection shall be easily accessible. The controller shall be U.L. listed, 120 volt, 60 Hertz, A.C. type. Controller shall have a 5-year warranty.
- B. Controller shall be as manufactured by Hunter model I-CORE IC-1200-PL with require modules.
- C. Station quantity shall be minimum of 12.

2.11 WEATHER SENSOR

- A. Weather sensor shall be polycarbonate in construction with adjustable interruption point and metal extension arm. Wireless weather sensor shall operate up to 800 feet from receiver unit and have built-in bypass switch on receiver panel.
- B. System operating frequency shall be 433MHz, UL listed, FCC approved.
- C. Receiver input power shall be 24 VAC from controller.
- D. Weather sensor shall carry a five (5) year warranty.
- E. Weather sensor shall be manufactured by Hunter Industries, model Solar Sync with stainless steel sensor guard.

2.12 CONTROLLER LIGHTNING PROTECTION

- A. Controller shall include factory-installed and factory-recommended lightning protection and shall be connected to a grid pattern consisting of a 5/8-inch diameter x 10-foot-long copper clad grounding rod with minimum #6 AWG, solid, insulated copper wire and a 4-inch x 96-inch x 0.0625-inch copper grounding plate as outlined below. Minimum 20-foot separation between rod and plate. Connection to rod shall be with Cadweld connector as specified. Connection to plate shall be performed by the plate manufacturer (Paige #182199) with 25 feet of insulated copper wire already attached. Grounding rod is to be covered by a 4-inch round, grated top, plastic valve cover with metal detection and six inches of 4 inch ADS or equal drainage pipe. Plate shall be installed in ground enhancement material. Plate shall be covered with 4-inch plastic grated cover with detection and minimum 36 inches of 4-inch drainage pipe. Ground rod and plate shall be UL listed.
- B. Controller shall be grounded to one rod and one plate. 10-foot rod shall be installed to its full length within 12 feet of the controller, but no less than 8 feet. Plate shall be installed at a 36-inch depth with 50 lbs. of PowerSet ground enhancement material spread evenly below the plate and 50 lbs. spread evenly above the plate in accordance with manufacturer's requirements. The grounding electrodes shall be installed at least 8 feet from the wires connected to the controller.

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- C. Controller shall be equipped with an Intermatic AG2401 or equal surge arrester on the incoming 120-volt power.

2.13 WIRE

- A. All valve control wire shall be minimum #14-awg, common #12-awg, single strand, solid copper; UL- approved direct burial AWG-U.F. 600V and shall meet all state and local codes for this service. Individual wires must be used for each zone valve. Common wire shall be white in color, control wire for spray and rotor zones shall be orange in color, and spare wires, installed where indicated on the drawings shall be blue. White color shall be used for common wire only.
- B. All in-ground wire connections shall be waterproofed with 3M DBY splice kits per Paige or equal and 3M or equal recommendations for the wire voltage and size being used. All wire splices shall be made in valve boxes or at a controller. All wire connectors and splices shall be UL Listed for direct burial.
- C. Wire type and method of installation shall be in accordance with local codes for NEC Class II circuits of 30-volt A.C. or less.

2.14 QUICK COUPLING VALVES

- A. Quick coupling valves shall be 1-inch inlet and outlet with anti-rotation wing. The quick coupling valve shall be a two-piece type. The valve body shall be constructed of heavy cast brass. The cover shall be a durable, protective self-closing vinyl or rubber cover. The valve shall be opened and closed by a brass key of the same manufacturer having a MNPT and FNPT outlet. The valve throat shall have a key way with ACME detent positions for regulating water flow.
- B. All quick coupling valves to have rubber or vinyl, non-locking covers.
- C. Quick coupling valves to be mounted on 1 inch PVC swing joints with brass insert. Minimum swing joint length to be 12 inches.
- D. Keys to utilize ACME threads and have long handles. Provide two (2) 1-inch ACME keys and two (2) 1-inch x 1-inch swivel hose bronze ells. Keys shall include a 1-inch ball valve between the key and the swivel hose ell. Use minimum 1-inch x 3-inch brass nipples between key and ball valve and ball valve and swivel ell.
- E. Quick coupling valves shall be as manufactured by Buckner Model QB44RCATAR10 or approved equal.

2.15 CRUSHED STONE

- A. Crushed stone shall be clean fill, maximum ¾-inch in size. Crushed stone shall be used under valve all boxes, regardless of content.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Before Work is commenced, hold a conference with the Owner's Representative to discuss general details of the Work.
- B. Examine all Contract documents applying to this Section noting any discrepancies and bringing the same to the attention of the Owner's Representative for timely resolution.
- C. Work indicated on drawings shall be provided whether or not specifically mentioned in the specifications.
- D. If there are ambiguities between drawings and specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification will be made only by Owner's Representative, and compliance with the decisions shall be required. In the event the installation contradicts the directions given, the installation shall be corrected at no additional cost to the Owner.
- E. Verify dimensions and grades at job site before Work is commenced. Do not proceed with installation of the irrigation system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Owner's Representative.
- F. Make all field measurements necessary for the Work noting the relationship of the irrigation Work to the other trades. Coordinate with other trades (landscaping and other site Work trades). Project shall be laid out essentially as indicated on the Irrigation Plans, making minor adjustments for variations in the final filed layout. Major changes shall be reviewed with the Owner's Representative prior to proceeding.
- G. Location of sprinkler equipment is contingent upon and subject to integration with underground utilities. Employ all data contained in the Contract Documents and verify this information at the construction site to confirm the manner by which it relates to the installation.
- H. During progress of Work, a competent superintendent, repair technicians and all assistants necessary shall be on site. All shall be satisfactory to the Owner's Representative. Superintendent shall not be changed, except with the consent of the Owner's Representative, unless that person proves unsatisfactory and ceases to be employed. Superintendent shall represent the Contractor in his absence and all directions given to the superintendent shall be as binding as if given to the Contractor.
- I. At all times, protect existing water lines, landscaping, paving, structures, walls, patios, footings, etc. from damage. Any inadvertent damage to the Work of another trade shall be reported at once.

3.2 PVC PIPE AND FITTINGS INSTALLATION

- A. Using proper width trencher chain, excavate a straight (vertical) and true trench to a depth of 2-inch of pipe invert elevation.
- B. Pulling of pipe sizes 2 inches and smaller shall be allowed. The bullet attachment to the plow blade shall be larger than the outside diameter of the pipes belled end. Pipe shall be installed

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such that its curvature does not exceed manufacturer's recommendations. Pulling of pipe shall be accomplished in as straight a line as possible, using 45 and 22-1/2 degree fitting where necessary.

- C. Loam or topsoil encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the drawings and stockpiled for subsequent replacement in the upper 6 inches of the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed therefore.
- D. Pipe shall be laid on undisturbed trench bottom provided suitable base is available - no rock; if not, excavate to 2-inch below pipe invert and provide and install sand base or crushed stone upon which to lay pipe.
- E. Backfilling shall be accomplished as follows: backfill material shall contain no foreign matter and no rock. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be laid-up in 6-inch (maximum) lifts and tamped to compaction with mechanical equipment. Compact backfill in trenches to dry density equal to the adjacent undisturbed soil, and conform to adjacent grades without dips, sunken area, humps, or other irregularities. Frozen material shall not be used for backfill.
- F. Make all solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow welded joints at least 15 minutes' set-up/curing time before moving or handling. When the temperature is above 80° F, allow connections to set minimum 24 hours before pulling or pressure is applied to the system. When temperature is below 80° F, follow manufacturer's recommendations. Provide and install for expansion and contraction as recommended. Wire shall be laid in same trench as mainline and at pipe invert (see Wire Installation).
- G. Mainline pipe shall have minimum 22 inches of COVER (excavate to invert as required by pipe size). Lateral pipe shall have minimum 16 inches of COVER (excavate to invert as required by pipe size).
- H. Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required conforming to Manufacturer's specifications.
- I. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times, when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping, which cannot temporarily be joined, shall be sealed to make as watertight as possible. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or backfilled until all water is removed from the trench. Pipe shall not be installed when water is in the trench (trenching), when precipitation is occurring, or when the ambient temperature is at 40° F or below (pulling). Pipe installed at temperatures below 40° F shall be removed and replaced at no cost to the Owner. Pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.
- J. Maintain 12-inch minimum clearance between sprinkler lines and lines of other trades. Do not install sprinkler lines directly above another line of any kind.
- K. Maintain 12-inch minimums between lines that cross at angles of 45 to 90 degrees.

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- L. Throughout the guarantee period refill any trenches that have settled due to incomplete compaction.
- M. Flushing of pipe shall occur prior to installation of any sprinklers, quick couplers, electric valves, etc. The flushing shall be for an adequate time and of quantity to assure the piping is free of all foreign objects.
- N. Pressure test mainline as per specifications.

3.3 PVC PIPE SLEEVING INSTALLATION

- A. Sleeving for walkways shall be installed where indicated on the drawings.
- B. Sleeving for walkways shall be installed by the Contractor as indicated on the plans.

3.4 ELECTRICAL WIRE CONDUIT INSTALLATION

- A. Conduit for under walkways shall be installed where indicated on the drawings. Electrical conduit shall be installed by the Contractor.
- B. All above ground wiring shall be installed in conduit.

3.5 SPRINKLER INSTALLATION

- A. Large rotary sprinklers shall be installed flush to grade on 1-inch prefabricated PVC unitized swing joint assemblies with integral O-rings, minimum length 12 inches as manufactured by Dura, Lasco or Spears.
- B. All sprinklers in the field shall be installed head to head (100% overlap) and not exceed maximum spacing indicated.
- C. Adjust sprinkler zone after installation using flow control on valve.

3.6 ELECTRIC CONTROL VALVE INSTALLATION

- A. Control valves shall be installed on a level crushed stone base. Grade of bases shall be consistent throughout the project so that finish grades fall within the limits of Work. Valves shall be set plumb with adjusting handle and all bolts, screws and wiring accessible through the valve box opening. Valves shall be set in a plumb position with 24-inch minimum maintenance clearance from other equipment.
- B. Install at sufficient depth to provide more than 6-inch, nor less than 4-inch cover from top of valve to finish grade.
- C. Adjust zone valve operation after installation using flow control and pressure regulating device on valve.