

ALNC 32 84 00 - 1 PLANTING IRRIGATION

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor is responsible for providing a system with full and complete coverage. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included are:

1. Procurement of all applicable licenses, permits, and payment of required fees.
2. Coordination of Utility Locates ("Call Before You Dig").
3. Maintenance period.
4. Sleeving for irrigation pipe and wire.

1.2 RELATED WORK

- A. Division 26, ELECTRICAL
- B. Section 328200, IRRIGATION PUMPS
- C. Section 329000, PLANTING
- D. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.3 QUALITY ASSURANCE

A. Contractor:

1. Irrigation Contractor must have demonstrated, using persons directly employed by the Contractor, experience with the construction of at least five (5) 18-hole golf course irrigation systems in the last 5 years. Two of these projects must have been the construction of an irrigation system on a new 18-hole golf course. This construction must include large diameter gasketed pipe (6-inch and larger), centralized control systems with two-wire decoder style control system, valve-in-head sprinklers, electrically operated remote control valves, large radius rotary sprinklers (minimum 1-inch inlet with swing joint) and pre-fabricated pump stations.

2. Irrigation Contractor must be licensed in the State of Illinois.

B. Equipment Manufacturer:

1. Manufacturer regularly and presently manufactures the item as one of their principal products.

C. System Requirements:

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1. Full and complete coverage in existing burial sections is not possible due to existing water alley spacing. Install sprinklers in existing burial sections as shown on drawings.

2. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout in new crypt fields and burial sections as required to achieve full coverage.

3. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown.

1.4 SUBMITTALS

A. Make submittal and provide number of copies per Specification Section 013323. Provide sections that are indexed and labeled for valves, sprinklers, pipe and fittings, decoders, two wire cable, wire connectors, ID tags, shop drawings, "DO NOT DRINK" sign and all other irrigation equipment shown or described on the drawings and within these specifications. Highlight items being supplied on the catalog cut sheets. Submittal package must be complete prior to being reviewed by

the Contracting Officer's Technical Representative. Incomplete submittals will be returned without review.

B. Materials List: Include all materials and products that are part of the irrigation system including, but not limited to: pipe, fittings, valves, mainline components, water emission components, and control system components. Quantities of materials need not be included.

C. Manufacturers' Data: Submit manufacturers' catalog cuts, specifications, and operating instructions for equipment shown on the materials list. For rotary sprinklers include Center for Irrigation Technology SpacePro Single Leg Profile showing the Distribution Uniformity and Scheduling Coefficient for the nozzles being used at the specified offset spacing.

D. Shop Drawings: Submit shop drawings called for in the installation details. Show products required for proper installation, their relative locations, and critical dimensions. Note modifications to the installation detail.

E. Testing: Submit a proof of testing report following completion of each test listed in Part 1 of these specifications. Unless otherwise noted, include name of test, date of test, name of the individual completing the test, name of the company completing the test and a summary of the test results. If system fails test, document any and all retests until system passes test.

F. Maintenance and Operation Instructions: Submit information listed in Part 3 of these specifications.

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G. Record Drawings: Submit information listed in Part 3 of these specifications.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.): RR-F-621E Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

C. American National Standard Institute (ANSI):

1. B40.1-91 Gauges-Pressure Indicating Dial Type Elastic Element

D. American Society of Agricultural Engineers (ASAE):

1. S398 Sprinkler Testing and Performance Reporting.

E. American Society for Testing and Materials (ASTM):

1. B61-93 Steam or Valve Bronze Castings

2. B62-93 Composition Bronze or Ounce Metal Castings

3. B209-96 Aluminum and Aluminum-Alloy Sheet and Plate

4. D1785-91 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120

5. D2241-89 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)

6. D2287-81 Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

7. D2464-91 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

8. D2466-90 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

9. D2564-94 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe And Fittings

10. D2855-96 Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

11. F2768-09 Modified Stub ACME Thread Joint with Elastomeric Seal in Plastic Piping Components

12. F477-90 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

13. F656-08 Primers for Use In Solvent Cement Joints of Poly (Vinyl

Chloride) (PVC) Plastic Pipe and Fittings

F. American Water Works Association (AWWA):

1. C110-93 Ductile-Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch for Water and Other Liquids

2. C111-90 Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.

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3. C115-94 Flanged and Ductile Iron and Gray Iron Pipe with Threaded Flanges

4. C151-93 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids

5. C153-94 Ductile-Iron Compact Fittings, 3 Inch Through 12-Inch for Water and Other Liquids.

6. C500-93 Gate Valves for Water and Sewerage Systems

7. C504-87 Rubber Sealed Butterfly Valves

8. C600-93 Installation for Ductile-Iron water Mains and Their Appurtenances

9. C901-02 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service

G. Manufacturers Standardization Society (MSS):

1. SP70-90 Cast Iron gate Valves, Flanged and Thread Ends

H. National Electrical Manufacturers Association (NEMA):

1. 250-85 Enclosures for Electrical Equipment (1000 Volts Maximum); Revision 1, May 1986

I. National Electric Code: (latest edition)

J. Uniform Plumbing Code: (latest edition)

1.6 RULES AND REGULATIONS

A. Work and materials will be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code, and applicable laws and regulations of the governing authorities.

B. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.

C. If quantities are provided either in these specifications or on the drawings, these quantities are provided for information only. It is the Contractor's responsibility to determine the actual quantities of all material, equipment, and supplies required by the project and to complete an independent estimate of quantities and wastage.

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1.7 AVAILABILITY AND USE OF UTILITY SERVICES

A. The government shall make NO utilities available to the Contractor from existing outlets and supplies except as follows. Upon completion of the irrigation system or completion of portions thereof, the contractor through the temporary connection of the new irrigation system to the potable water system, shall be provided water for flushing and testing of the new irrigation system. Once the system is deemed operable and approved, and prior to the final inspection, the contractor may use water at no cost through the irrigation system for establishing turf and maintaining plant material. No other expressed or implied uses of government furnished water exist.

B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Resident Engineer, shall install and maintain all necessary temporary connections and distribution lines, and meters required by the public utilities. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated appurtenances.

1.8 DEMOLITION

- A. Remove or abandon existing pipe, valves, sprinklers, and other irrigation components as indicated on the drawings. Remove in a manner that minimizes damage to the components and the adjoining area. Protect burial sections from damage due to construction equipment. Deliver salvageable items to Resident Engineer. Abandoned Pipe should not be within 12-inches of the finished grade.
- B. Remove existing irrigation controllers as indicated on the drawings.
- C. Remove existing hose reel connection vaults as indicated on the drawings.
- D. Remove components in existing hose reel connection vaults as indicated on the drawings.

1.9 TESTING

- A. Notify the Contracting Officer's Technical Representative five working days in advance of testing.
- B. Subject pipelines jointed with rubber gaskets or threaded connections to a pressure test after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints will be allowed to cure at least 24 hours before testing.
- C. Subsections of mainline pipe may be tested independently, subject to the review of the Contracting Officer's Technical Representative.
- D. Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.
- E. Backflow Prevention Device Test:
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 - 1. Test backflow prevention device as required by water purveyor.
 - 2. Use a licensed tester. Provide written evidence of certification or license prior to conducting test.
 - 3. Complete test prior to operational test.
 - 4. Correct any deficiencies. Repeat until device passes test.
- F. Provide written report of test data as required by water purveyor. Submit report to the Contracting Officer's Technical Representative.
- G. Volumetric Leakage Test - Gasketed Mainline Pipe:
 - 1. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
 - 2. Purge all air from the pipeline before test.
 - 3. Subject mainline pipe to the anticipated operating pressure of 100 PSI for two hours. Maintain constant pressure. The amount of additional water pumped in during the test will not exceed:
 - a 0.31 gallons per 100 joints per hour of 3-inch diameter pipe
 - b 0.541 gallons per 100 joints per hour of 4-inch diameter pipe
 - c 0.811 gallons per 100 joints per hour of 6-inch diameter pipe
 - d 1.081 gallons per 100 joints per hour of 8-inch diameter pipe
 - 4. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
 - 5. Cement or caulking to seal leaks is prohibited.
- H. Leakage Test - Connection to Existing Mainline Pipe:
 - 1. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
 - 2. Purge all air from the pipeline before test.
 - 3. Subject connection to existing mainline pipe to the anticipated operating pressure of 100 PSI for two hours. Maintain constant pressure.
 - 4. Leakage will be detected by visual inspection. Replace defective fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
 - 5. Cement or caulking to seal leaks is prohibited.
- I. Hydrostatic Pressure Test - Solvent Weld Submainline and Lateral Pipe:

1. Subject pipe to a hydrostatic pressure equal to the anticipated operating pressure of 80 PSI for 30 minutes.
2. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
3. Leakage will be detected by visual inspection. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.

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4. As an alternative to the visual inspection described in Item 4. above, the Contracting Officer's Technical Representative may request that a pressure drop test be performed:

a Purge air from pipe before test. Attach pressure gauge to a riser in the middle of the lateral. Cap all sprinkler risers.

b Pressurize the lateral via the remote control valve then turn down flow control handle on remote control valve to seal off lateral.

c Observe pressure loss on pressure gauge. If pressure loss is greater than 5 PSI, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pressure loss is equal to or less than 5 PSI.

5. Cement or caulking to seal leaks is prohibited.

6. After lateral passes test and prior to operational test, install sprinklers and backfill and compact all pipe, fittings, joints, or appurtenance.

J. Operational Test - Backflow Prevention Device and Piping to Tank:

1. Fill backflow prevention device and piping to tank with water by opening manual valve and flowing water into storage tank. Contracting Officer's Technical Representative will visually observe operation and leakage.

2. Replace defective pipe, fitting, joint, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.

3. Repeat test until piping passes test. Repeat test, replace components, and correct deficiencies at no additional cost to the Owner.

4. Close valve to storage tank and drain backflow prevention device and piping after successfully completing test.

K. Operational Test - Valve-in-Head Sprinklers; Remote Control Valves, Lateral Piping and Sprinklers:

1. Activate each valve-in-head sprinkler and/or remote control valve in sequence from central controller using remote. Manual operation of the sprinklers or valves is not an acceptable method of activation.

The Contracting Officer's Technical Representative will visually observe operation, water application patterns, and leakage.

2. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.

3. Replace, adjust, add, or move water emission devices to correct operational or coverage deficiencies.

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4. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.

5. Repeat test(s) until each lateral pass all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.

L. Distribution Uniformity (DU):

1. Perform a DU Test on one zone of burial section rotors and one zone of tree lawn rotors per burial section.

2. In conjunction with the Contracting Officer's Technical

Representative, select the zones of sprinklers that are representative of the area being irrigated by the burial section.

3. Perform a catch can test using procedures recommended by the Irrigation Association.

4. Calculate and provide a written documentation of the DU for each zone tested.

5. An Irrigation Association Certified Landscape Irrigation Auditor must perform the test. Provide written evidence of certification prior to conducting test.

M. Control System Grounding:

1. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.

2. Replace defective wire, grounding rod or appurtenances. Repeat the test until the manufacturer's guidelines are met.

3. A written report of the test data listing each line surge decoder or grounding rod number and location, date of test, name of the individual completing the test, name of the company completing the test and the ohms resistance to ground must be submitted to the Contracting Officer's Technical Representative.

N. Acceptance Test Prior to Final Inspection:

1. Upon completion of construction and prior to Final Inspection, an Acceptance Test must be passed.

2. Coordinate start of Acceptance Test with Contracting Officer's Technical Representative.

3. During the Acceptance Test, the irrigation system must be fully operational from the control system. The irrigation system must operate with no faults for 14 consecutive days. If at any time during the 14 day test period, a system fault occurs, the source of the fault must be determined and corrected and the 14 day evaluation

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period will start again. If a system fault occurs, make repairs within 72 hours of notification from Contracting Officer's Technical Representative. Document any faults in the proof of test report listing date of fault, fault, cause of the fault and the corrective action taken.

4. If the fault is found to be due to factors outside of the contractor's control (for example, mainline pipe break in area not being renovated) the evaluation period will continue.

5. When the system has operated for 14 days without fault, contact the Contracting Officer's Technical Representative to schedule Final Inspection.

1.10 CONSTRUCTION REVIEWS

A. The purpose of on-site reviews by the Contracting Officer's Technical Representative is to periodically observe the work in progress, the Contractor's interpretation of the construction documents, and to address questions with regard to the installation.

1. Schedule reviews for irrigation system layout or testing with the Contracting Officer's Technical Representative as required by these specifications.

2. Impromptu reviews may occur at any time during the project.

3. A Final Inspection will occur at the completion of the irrigation Acceptance Test. The intent of the Final Inspection is to verify that all installation; testing; maintenance and operation submittals; and project record drawing submittals are completed prior to the start of the Maintenance and Guarantee/Warranty periods.

4. All costs, including travel expenses and site visits by the Veterans

Administration or Veterans Administration representative(s) for additional Inspection(s) that may be required after the Final Inspection due to non-compliance with the Construction Documents are the sole responsibility of the Contractor.

1.11 GUARANTEE/WARRANTY AND REPLACEMENT

A. The purpose of this guarantee/warranty is to insure that the Government receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.

B. Guarantee/warranty irrigation materials, equipment, and workmanship against defects for a period of one year from Final Inspection by Contracting Officer's Technical Representative. Fill and repair depressions. Restore landscape, utilities, structures or site features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by construction or a defective item. Make ALNC - 915CM2003 32 84 00 - 10 PLANTING IRRIGATION repairs within 72 hours of notification from Contracting Officer's Technical Representative.

C. Replace damaged items with identical materials and methods per contract documents or applicable codes. Make replacements at no additional cost to the contract price.

D. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

1.12 GENERAL CONSTRUCTION REQUIREMENTS

A. Coordinate construction of irrigation system with Contracting Officer's Technical Representative and Cemetery Staff. See irrigation plans and installation details for required coordination efforts related to the installation of specific irrigation components.

B. Control of Excavations: See Section 3.3 for safety and access directions.

C. Install irrigation components in landscaped areas only.

D. Construction cannot proceed unless staking of irrigation mainline, remote control valve locations, and sprinkler locations are reviewed and accepted by the Contracting Officer's Technical Representative.

PART 2 - MATERIALS

2.1 QUALITY

A. Use new materials without flaws or defects.

2.2 SUBSTITUTIONS

A. Unless noted otherwise, use specified equipment. Contracting Officer's Technical Representative must approve equipment prior to construction. The Contractor through written request prior to purchase or installation may request substitutions to the approved equals listed herein. Changes and associated design costs to accommodate alternative equipment are Contractor's responsibility.

B. Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at Contractor's option.

2.3 SLEEVING

A. Provide sleeve beneath hardscape for irrigation pipe and wiring. Provide separate sleeve beneath hardscape for wiring.

B. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.

C. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241 for mainline pipe, lateral pipe and wiring sleeves.

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D. Size sleeves are as shown on the drawings. Wiring bundle contained in

the sleeve should not exceed 40% of the available area within the sleeve per NEC recommendations.

2.4 PIPE AND FITTINGS

A. Mainline Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241.
3. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe. Gasketed pipe joints must conform to the "Laboratory Qualifying Tests" section of ASTM D3139. Gasket material must conform to ASTM F477. Use push-on rubber-gasketed ductile iron fittings conforming to ASTM A536 and ASTM F477. Use lubricant approved by the pipe manufacturer. Acceptable manufacturer for ductile iron fittings is Harco or approved equal.
4. Mainline pipe within sleeves: Provide restrained casing spacers for gasketed joints that occur within sleeve and as necessary along pipe length. Acceptable manufacturer for casing spacers is Ford Meter Box Company or approved equal.

B. Submainline Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241.
3. Use solvent weld pipe for submainline pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Primer for use with solvent cement to conform to ASTM F656 and purple in color. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.

C. Lateral Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.

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2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the case of small nominal diameters not manufactured in Class 200.
3. Use solvent weld pipe for lateral pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Primer for use with solvent cement to conform to ASTM F656 and purple in color. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.

D. Specialized Pipe and Fittings:

1. Ductile Iron Pipe: Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use minimum of Class 53 thickness pipe for flanged piping.
2. Use mechanical joints conforming to ANSI A 21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).
3. Joint sealant: Use only teflon-type tape or teflon based paste pipe joint sealant on plastic threads. Use nonhardening, nontoxic pipe

joint sealant formulated for use on water-carrying pipes on metal threaded connections.

E. Thrust Blocks:

1. Use thrust blocks for fittings on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe. Use of mechanical restraints does not eliminate the need for installation of thrust blocks as specified.
2. Use 3,000-PSI concrete.
3. Use 2-mil plastic.
4. Use No. 4 Rebar wrapped or painted with asphalt tar based mastic coating.

F. Joint Restraint Harness:

1. Use a joint restraint harness as presented in the installation details and wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
2. Use a joint restraint harness with all ductile iron fittings 6-inch and larger, transition fittings between metal and PVC pipe, where weak trench banks do not allow the use of thrust blocks, or where extra support is required to retain a fitting or joint.
3. Use a joint restraint harness on all mainline gate valve assemblies 6-inch and larger.
4. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials that are stainless steel. Use retainer ALNC - 915CM2003 32 84 00 - 13 PLANTING IRRIGATION conforming to ASTM A536. Use high strength, low alloy steel bolts and connecting hardware conforming to ANSI/AWWA C111/A21.11.
5. Acceptable manufacturer is EBBA Iron Megalug Series or approved equal.

2.5 MAINLINE COMPONENTS

A. Backflow Prevention Assembly:

1. As presented in the installation details.
2. Use a reduced pressure principal backflow prevention device, ductile iron valve body with fusion epoxy coating, bronze relief valve and trim, stainless steel springs, OS&Y and NRS shut-offs and rated for maximum 175 PSI working pressure. Acceptable manufacturer and model is Febco 880V or approved equal.
3. Use a bronze boiler drain, male to hose configuration, bronze handwheel and rated to 125 PSI working pressure. Size $\frac{3}{4}$ -inch. Acceptable manufacturer and model is Nibco 74-CL or approved equal.
4. Use hose connection vacuum breaker rated for 125 PSI working pressure. Acceptable manufacturer and model is Apollo 38-304-AS or approved equal.

B. Isolation Gate Valve Assembly:

1. As presented in the installation details.
2. Iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 200 PSI minimum working pressure and mechanical joint ends meeting AWWA Standard C509. Acceptable manufacturers are Clow, Kennedy, Mueller or approved equal.
3. Valve Box: Use plastic (ABS) 10-inch round valve box with black lid. Acceptable manufacturer is Pentek or approved equal.
4. Filter Fabric: Use a spunbond polyester 3.5 oz. per square yard landscape fabric.

C. Air-Vacuum Relief Valve Assembly:

1. As presented in the installation details.
2. Cast Iron body with epoxy coating, polypropylene float, glass fiber reinforced nylon kinetic float, Buna-N seals and O-rings, stainless

steel nuts and bolts, pressure range 2 PSI to 230 PSI. Use a continuous acting combination air and vacuum and air release valve. Acceptable manufacturer is Bermad, Crispin, Fresno, Waterman or approved equal.

3. PVC Ball Valve: Use a true union ball rated to 235 PSI. Use valve with safe-t-blocked seal carrier (full rated pressured) safe-t-shear ALNC - 915CM2003 32 84 00 - 14 PLANTING IRRIGATION stem, and self adjusting floating seat. Acceptable manufacturer is Spears or approved equal.

4. Valve Box: Use plastic (ABS) jumbo rectangular valve box with black lid. Acceptable manufacturer is Pentek or approved equal.

5. Filter Fabric: Use a spunbond polyester 3.5 oz. per square yard landscape fabric.

D. Quick Coupling Valve Assembly:

1. As presented in the installation details.

2. Brass construction, 1-inch nominal size, operating pressure 5-125 PSI with locking rubber or vinyl cover. Acceptable manufacturer and model is Rain Bird 5RC to match existing equipment or approved equal.

3. Swing Joint: Use pre-manufactured triple swing joint. Acceptable manufacturer is Rain Bird, Spears, Lasco or approved equal.

4. Quick Coupler Anchor: Use pre-manufactured bolt on anchor. Acceptable manufacturer is Harco or approved equal.

5. Valve Box: Use plastic (ABS) 10-inch round valve box with black lid. Acceptable manufacturer is Pentek or approved equal.

6. Filter Fabric: Use a spunbond polyester 3.5 oz. per square yard landscape fabric.

E. Flower Water Station Hydrant Connection Assembly:

1. As presented in the installation details.

2. Yard Hydrant: Water spigot fountain shall be from a manufacturer with at least 5 years of experience producing similar products. Hydrant to operate with an inlet water pressure of 40 PSI and be gravityevacuated from inner supply column when valve is shut off via drainage ports in the bottom. Stock, top and base to be fabricated of heavy, one-piece iron castings finished with a heavy grade of oilbased VS bronze enamel. Finish coat to match Victor Stanley Bronze color. Handle to be aluminum-bronze casting. Nozzle to be solid brass casting with threaded ¾-inch hosed connection, omniflow outlet and vacuum breaker. Handle to be self-closing and operate with 5 lbs or less of force when the water pressure to the spigot is provided at 40 PSI or less. Inner supply assembly to use solid-brass castings conforming to ASTM B61 and B62. Outer casing and inner supply line to be galvanized steel pipe. Hydrant to allow top access for replacement of the anti-freezing mechanism. Height above grade and depth of bury as shown on the drawings. Final configuration including the mounting method to be approved during the submittal process. Acceptable manufacturer and model is Murdock M-175VA.

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3. Curb Stop Valve: Brass body, 300 PSI minimum working pressure. ASTM B-62, female threaded connections, with stop and waste feature. Acceptable manufacturers are Ford, Mueller, A.Y. McDonald or approved equal.

4. Inline pressure regulator, 40-45 PSI, 1-inch inlet and outlet. Acceptable manufacturers and models are Rain Bird PSI-M40X-100 and Senniger Model PSR-40 or approved equal.

5. Supply Pipe: Use solvent weld, Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241. Use Schedule 40, Type 1, PVC solvent weld fittings conforming

to ASTM Standards D2466 and D1784 for PVC pipe. Primer for use with solvent cement to conform to ASTM F656 and purple in color. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.

6. Valve Box: Use F08 concrete curb valve box with cast iron lid sized 8" ID x 11¾" high. Valve box must be capable of being face anchored in concrete. Acceptable manufacturer and model is Christy Concrete Products F08 Box (standard) or approved equal.

2.6 SPRINKLER IRRIGATION COMPONENTS

A. Remote Control Valve Assembly:

1. As presented in the installation details.

2. Remote Control Valve: Use a normally closed 24 VAC 50/60 cycle solenoid actuated globe pattern design. The valve pressure rating will not be less than 200 PSI. The valve body and bonnet will be constructed of heavy-duty glass-filled UV resistant nylon and have stainless steel studs and flange nuts; diaphragm will be of nylon reinforced nitrile rubber. The valve will have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electrically energizing the solenoid. The valve's internal bleed will prevent flooding of the valve box. The valve will house a fully encapsulated, one-piece solenoid. The solenoid will have a captured plunger with a removable retainer for easy servicing and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid will open with 19.6 volt minimum at 200 PSI. At 24 VAC, average inrush current will not exceed 0.41 amps. Average holding current will not exceed 0.23 amps. The valve will have a brass flow control stem for accurate manual regulation and/or shutoff of outlet flow. The valve must open or close in less than 1 minute at 200 PSI and less than 30 seconds at 20 PSI. The valve will have a self-cleaning stainless steel screen designed for use in dirty water applications. Provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The valve will have a pressure regulation module to regulate outlet pressure as specified. Acceptable manufacture and model is Rain Bird PESB to match existing equipment or approved equal.

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water applications. Provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The valve will have a pressure regulation module to regulate outlet pressure as specified. Acceptable manufacture and model is Rain Bird PESB to match existing equipment or approved equal.

3. PVC Ball Valve: Use a true union ball rated to 235 PSI. Use valve with safe-t-blocked seal carrier (full rated pressured) safe-t-shear stem, and self adjusting floating seat. Acceptable manufacturer is Spears or approved equal.

4. PVC Union: Use a Schedule 40 threaded union with O-ring seal. Acceptable manufacturer is Spears or approved equal.

5. Valve Box: Use plastic (ABS) standard valve box with black lid or combination of standard and round valve boxes with black lid. Acceptable manufacturer is Pentek or approved equal.

6. Filter Fabric: Use a spunbond polyester 3.5 oz. per square yard landscape fabric.

7. Install assembly over gravel sump as presented in the installation details.

8. Wire connectors: Use 3M DBY or DBR.

9. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background.

B. Large Turf Sprinkler Assembly:

1. As presented in the installation details.

2. Sprinkler: Use a valve-in-head gear drive sprinkler capable of covering the radius with the discharge rate at the pressure as presented on the drawings. Furnish part circle sprinklers with a

minimum adjustable arc of 30- to 345-degrees, and full circle sprinklers with a non adjustable arc. Nozzle must be tested per ASAE S398.1 and be verified to deliver Distribution Uniformity of 80% or more and a Scheduling Coefficient of 1.2 or less at the specified offset spacing. Furnish sprinkler with closed case construction, self flushing mode at pop-up an pop-down, stainless steel retract spring, ACME inlet threads, minimum 1 1/2-inch size inlet, top serviceable rock screen, replaceable valve seat, pressure regulation range from 60 to 100 PSI and nozzle trajectory of 25-degrees. Minimum pop-up height is 3 1/4-inches. Acceptable manufacturer and models are Rain Bird Eagle 900 and 950 to match existing equipment or approved equal.

3. Swing Joint: Use pre-manufactured triple swing joint compatible with service tee. Use ACME threads on inlet and outlet per ASTM F2768.

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Acceptable manufacturer is Rain Bird, Spears, Lasco or approved equal.

4. Service Tee: Use PVC solvent weld service tee rated at 315 PSI working pressure and tested at 788 PSI per ASTM F1970. Use service tee with solvent weld ends and 1 1/2-inch ACME thread outlet. Acceptable manufacturer is Lasco or approved equal.

C. Pop-Up Rotor Sprinkler Assembly:

1. As presented in the installation details.
2. Rotary Sprinkler: Use a gear drive sprinkler capable of covering the radius with the discharge rate at the pressure as presented on the drawings. Furnish part circle sprinklers with an adjustable arc of 20- to 340-degrees, and full circle sprinklers with a non adjustable arc. Furnish sprinkler with stainless steel pop-down spring. Nozzle must be tested per ASAE S398.1 and be verified to deliver Distribution Uniformity of 80% or more and a Scheduling Coefficient of 1.2 or less at the specified offset spacing. Furnish sprinkler with stainless steel risers, integral check valve in base of the case capable of holding back 10 feet of elevation. Minimum pop-up height is 3 ½-inches. Acceptable manufacturer and models is Rain Bird 8005 and 5000 to match existing equipment or approved equal.
3. Swing Joint: Use pre-manufactured triple swing joint. Acceptable manufacturer is Rain Bird, Spears, Lasco or approved equal.

D. Pop-Up Spray Sprinkler Assembly:

1. As presented in the installation details.
2. Sprinkler: Use a spray sprinkler capable of covering the radius with the discharge rate at the pressure as presented on the drawings. Furnish sprinkler with pressure reducing module in the riser stem and integral check valve in base of the case capable of holding back a minimum of 8 feet of elevation. Minimum pop-up height is 4-inches. Acceptable manufacturer and model is Rain Bird 1800-SAM-PRS to match existing equipment or approved equal.
3. Low Density Polyethylene Hose (Swing Pipe): Use pipe specifically intended for use as flexible swing joint. Use spiral barb fittings supplied by the same manufacturer as hose. Acceptable manufacturer is Rain Bird to match existing equipment or approved equal.

E. Below Grade Tree Bubbler Assembly:

1. As presented in the installation details.
2. Use a prefabricated root watering system complete with bubbler, 4-inch diameter semi-rigid mesh tube with retaining cap and vandal resistant locking grate, and swing joint. Furnish assembly with sand sock. Minimum height is 36-inches. Acceptable manufacturer and model is Rain Bird RWS-B-1401 or approved equal.

3. Low Density Polyethylene Hose (Swing Pipe): Use pipe specifically intended for use as flexible swing joint. Use spiral barb fittings supplied by the same manufacturer as hose. Acceptable manufacturer is Rain Bird to match existing equipment or approved equal.

2.7 CONTROL SYSTEM COMPONENTS

A. Central Control System:

1. Description: Irrigation control system of the type typically used for irrigation systems control from a central location. Provide, install and test control system complete with desk top microcomputer, software, printer, peripherals, interface components, communication hardware and software, and decoder units. Provide 5 years of phone and troubleshooting support. Acceptable manufacturers and models are Rain Bird Site Control w/ GSP support to match existing equipment or approved equal.

2. Software: Provide to the Owner a software license-to-use document specifying terms and conditions of the license-to-use including the training, support, and update provisions noted herein. Provide latest version of available at time of construction, along with a 5-year technical support and software upgrade plan.

3. Basic Capabilities: Minimum capabilities to include:

a Hard wire communication between the central controller and decoders.

b Flow management to include hydraulic model of irrigation system with definitions of water source and pipe network and a flow analysis and optimization to show flow during operation or modeled operation.

c Global percent scaling or water budgeting of all stations.

d Ability to repeat water application cycles with a soak time between each application.

e Automatic chronological event log.

f Weather station compatible to report evapotranspiration from an on-site weather station (ET Software Module).

g Compatible with the provided handheld radio system that allows remote operation of the system through the central control system.

h Capable of sensor feedback to the central system.

i Future software updates at no cost for a minimum of five years.

j On-site service and repair for two years.

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4. Handheld radio system: Provide three (3) handheld remote radios each with a charging unit compatible with the Central Control System.

System must allow for wireless communication to control the irrigation system via a radio and voice transmission from the same handheld unit. Radios must use a radio frequency that is approved for use for the Veterans Administration. Control system manufacturer is responsible for acquiring all necessary licenses for use of the handheld remote radios.

5. Training: Provide four training sessions, for up to three user personnel, conducted by the control system manufacturer's training personnel, on-site using the project's central control system, including handheld radio, at a place and time to be determined. Each training session should be for a period of not less than 4-hour each and scheduled on different days. The Contractor must help schedule and coordinate the training session. Training must include an overview of system operations and functions, troubleshooting techniques, user maintenance as well as detailed one-on-one training for selected individuals.

6. Technical Manuals: Provide three (3) copies of all user technical

manuals.

7. Support: The control system manufacturer is to provide phone-in support to the Owner at no cost for a period of 5 years within the initial purchase price of the system.

B. Decoder Interface Unit:

1. As required by the control system manufacturer.
2. Lightning protection: Connect to building ground per manufacturer's recommendations.

C. Decoder Units:

1. Use decoders compatible with the central control system. Acceptable manufacturer is Rain Bird FD-TURF series or approved equal.

2. Decoder Types:

a Use a single address decoder that interfaces with one or two solenoids VIH sprinklers as presented in the drawings.
b Use single address decoder that interfaces with one, two or four solenoids for remote control valves as presented in the drawings.
3. Provide line surge protection as required by control system manufacturer.

4. Provide grounding as required by control system manufacturer. Use 5/8"x8 foot copper clad UL listed grounding rod at interval recommended by control system manufacturer.

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5. Electrical conduit: Use PVC Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D-1785. Fittings for PVC conduit will be Schedule 40, Type 1, PVC solvent weld fittings, ASTM Standards D2466 and D1784.

D. Communication Cable:

1. Use shielded and jacketed cable designed for direct burial, as recommended by the central control system manufacturer.
2. Splices: Use splice connector as recommended by central control system manufacturer.

E. Controller Wire:

1. Control Wire: Use American Wire Gauge (AWG) #14 solid copper, Type UF or PE cable, UL listed for direct underground burial from decoder to solenoid at VIH sprinkler or remote control valve assembly.
2. Common wire: Use American Wire Gauge (AWG) #12 solid copper, Type UF, Penteked, UL listed for direct underground burial from the decoder to solenoid at VIH sprinkler or each remote control valve assembly.

3. Construction of UF Wire:

a Conductor: Solid-annealed, uncoated copper conforming to UL Standard 719, Parts 18-22.
b Insulation: Polyvinyl chloride, 60°C rated conforming to UL Standard 719, Parts 23-25.
c Construction Data: UL heavy duty PVC, colored, conforming to UL Standard 44.

d Manufacturer's Identification: Surface embossed with manufacturer's name, voltage rating, size and type designation.

e Underwriters Laboratories Approval: All cables will be tested physically and electrically in accordance with UL Standard 719 and will bear UL labels.

4. Construction of PE Wire:

a Conductor: Soft drawn bare copper meeting the requirements of ASTM Specification B-3 or B-8.
b Temperature Rating: -55°C to + 60°C.
c Insulation Thickness: .045"
d Pentek: 0.005" x .5" type 304 stainless steel tape helically wrapped with a minimum of 33% overlap.

e Manufacturer's Identification: Surface marked with voltage rating, size and type, and UL file number.

f Underwriters Laboratories Approval: All cables will be tested physically and electrically in accordance with UL Standard 493 and ALNC - 915CM2003 32 84 00 - 21 PLANTING IRRIGATION

83 (paragraphs 28.1, 29.1, and 29.2). All reels and cartons bear UL labels.

g Tests: Material must be able to pass the following tests without showing signs of degradation.

(1) Cold bend: The insulation will not show any cracks when sample is bent around a mandrel of 3 x wire diameter after being subjected to -55°C +/- 1°C for one hour.

(2) Electrical: AC test voltage, 5 minutes at 3,000 volts.

(3) Environmental Aging: Immersed for 14 days in concentrated solutions of fertilizers, herbicides and insecticides.

5. Color: Use white for common ground wire. Use easily distinguished colors for other control wires. Wire color must be continuous over its entire length.

6. Splices: Use 3M DBR/Y splices.

7. Valve Box: Use plastic standard rectangular valve with black lid.

8. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide colored red and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW", in black lettering.

F. Instrumentation:

1. Weather Station:

a Use a station that is compatible with specified control system and which can be used for daily irrigation scheduling adjustments.

b Weather station is to be automatically interrogated at interval set by owner, and reports of local reference evapotranspiration (ET_o) rates and rainfall are to be determined and reported. ET_o rate calculation is based on ASCE standardized equation.

c Ability to terminate irrigation events at user preset wind velocity thresholds,

d Ability to terminate irrigation events when temperature drops below user preset threshold.

e Ability to terminate irrigation events during or immediately after rainfall events

f Ability to terminate irrigation events with soil moisture monitor to override irrigation in event of high soil moisture

g System interrogation is to occur from the same microcomputer used for centralized irrigation control system. Communication to weather station is to be cat5 communication cable and terminal ends or approved alternative.

2. Lightning protection: Provide one 12"x36"x0.0625" ground plate, earth ALNC - 915CM2003 32 84 00 - 22 PLANTING IRRIGATION

contact enhancement material, one 5/8"x10 foot copper clad UL listed grounding rod, approximately 20 feet of #6 AWG bare copper grounding wire, 6-inch plastic round valve boxes and CADWELD connectors at weather station.

2.8 OTHER COMPONENTS

A. Tools and Spare Parts: Provide operating keys, servicing tools, spare parts and other items indicated in the General Notes of the drawings.

B. Other Materials: Provide other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.

PART 3 - EXECUTION

3.1 INSPECTIONS AND REVIEWS

A. Site Inspections:

1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the Contracting Officer's Technical Representative prior to beginning work.
2. Beginning work of this section implies acceptance of existing conditions.

B. Utility Locates ("Call Before You Dig"):

1. Arrange for and coordinate with local authorities the location of all underground utilities, and with cemetery maintenance personnel.
2. Repair any underground utilities damaged during construction. Make repairs at no additional cost to the contract price.

C. Irrigation System Layout Review: Irrigation system layout review will occur after the staking has been completed. Notify the Contracting Officer's Technical Representative one week in advance of review. The Contracting Officer's Technical Representative will identify modifications during this review.

3.2 LAYOUT OF WORK

A. Stake locations of sprinklers in existing burial sections. Use alleys as identified on the drawings.

B. Stake out the irrigation system. Items staked include: irrigation mainline pipe, thrust blocks, isolation gate valve assemblies, air/vacuum relief valve assemblies, quick coupling valves, remote control valves, lateral piping, and sprinklers.

C. If staked irrigation components conflict with utilities or other components or site features, coordinate rerouting of components with Contracting Officer's Technical Representative.

3.3 EXCAVATION, TRENCHING, AND BACKFILLING

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A. Excavate to permit the pipes to be laid at the intended elevations and to permit workspace for installing connections and fittings.

B. Existing Survey Markers:

1. Protect markers during construction.
2. If a survey marker is disturbed during construction, the Contractor is responsible for replacing the marker. The Contractor must hire a licensed surveyor to resurvey the location of the marker and replace it.

C. Minimum cover:

1. Match existing irrigation mainline pipe when connecting to pipe. Transition to mainline pipe depth after Isolation Gate Valve Assembly.
2. 48-inches over irrigation mainline pipe in landscaped areas. (distance from top of pipe to finish grade)
3. 18-inches over irrigation submainline pipe to sprinklers. (distance from top of pipe to finish grade)
4. 18-inches over irrigation lateral pipe to sprinklers. (distance from top of pipe to finish grade)
5. 2-inches over irrigation pipe in pre-placed crypt fields. (distance from top of pipe to top of crypt lid, see installation detail)
6. 18-inches over two-wire cable or control wire when not in common trench with mainline or lateral piping. (distance from top of wire to finish grade)
7. 18-inches vertical separation between lateral and mainline pipe installed in a common trench.
8. 2-inches minimum horizontal separation between pipes and wiring in a common trench.

9. Install sleeves at depth to maintain specified depth of pipe or wire routed through sleeve.
- D. Install and maintain safety fencing around all unattended excavation. Place safety signs adjacent to construction area roadway to the satisfaction of the Contracting Officer's Technical Representative.
- E. All excavations must be backfilled by the end of each workday. Do not leave any open trenches overnight, on weekends or on holidays.
- F. If trenching operation restricts access to a burial section, provide plywood and safety fencing across open trench to allow access to burial section. Provide access to the satisfaction of the Contracting Officer's Technical Representative.
- G. Excavated material is generally satisfactory for backfill. Backfill will be free from rubbish, vegetable matter, frozen materials, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe will be free of sharp objects that may damage the pipe.
- H. Enclose pipe and wiring beneath roadways, walks, curbs, etc in sleeves. Backfill sleeves in the following manner:
1. Backfill trench using excavated material in 6-inch layers. Minimum compaction of backfill for sleeves shall be a minimum 95% Standard Proctor Density, ASTM D698-78. Backfill to bottom of road base under roads or to finish grade under walks and curbs.
- I. Backfill mainline pipe, lateral pipe and wiring in turf areas in the following manner:
1. Backfill the trench by depositing the backfill material equally on both sides of the pipe or wire in 6-inch layers and compacting to the density of surrounding soil.
- J. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves.
- K. Dress backfilled areas to original grade. Remove excess backfill to onsite location as directed by the Contracting Officer's Technical Representative.
- L. Where utilities conflict with irrigation trenching and pipe work, contact the Contracting Officer's Technical Representative for trench depth adjustments.

3.4 SLEEVING AND BORING

- A. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends a minimum of 12-inches beyond the edge of the paved surface. Cover pipe ends and mark edge of pavement with a chisel or saw.
- C. Verify that sleeve sizing is adequate prior to installation. Note that sleeves required for pipe with restrained casing spacers are larger than twice the diameter of the pipe.

3.5 ASSEMBLING PIPE AND FITTINGS

- A. General:
1. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.
 2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.

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3. Trenches may be curved to change direction or avoid obstructions within the limits of the curvature of the pipe. Minimum radius of curvature and offset per 20-foot length of mainline and lateral pipe by pipe size are shown in the following table. All curvature results from the bending of the pipe lengths. No deflection will be allowed at a pipe joint.

SIZE RADIUS OFFSET PER

20' LENGTH

1 ½" 25' 7'-8"

2" 25' 7'8"

2 ½" 100' 1'-11"

3" 100' 1'-11"

4" 100' 1'-11"

6" 150' 1'-4"

8" 200' 1'-0"

B. Mainline Pipe and Fittings:

1. PVC Rubber-Gasketed Pipe:

a Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.

b Ductile iron fittings will not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.

2. Fittings: The use of cross type fittings is not permitted.

C. Submainline Pipe and Fittings:

1. PVC Solvent Weld Pipe:

a Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.

b Cure for 30 minutes before handling and 24 hours before pressurizing or installing with vibratory plow.

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c Snake pipe from side to side within trench.

2. Fittings: The use of cross type fittings is not permitted.

D. Lateral Pipe and Fittings:

1. PVC Solvent Weld Pipe:

a Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.

b Cure for 30 minutes before handling and 24 hours before pressurizing or installing with vibratory plow.

c Snake pipe from side to side within trench.

2. Fittings: The use of cross type fittings is not permitted.

E. Specialized Pipe and Fittings:

1. Ductile Iron Pipe: Install in accordance with accepted industry practices. Use pipe stands to support pipe at 5-foot intervals.

2. Mechanical joint connections: Install fittings, fasteners and gaskets in manner recommended by manufacturer and in accordance with accepted industry practices.

3. PVC Threaded Connections:

a Use only factory-formed threads. Field-cut threads are not permitted.

b Apply thread sealant in manner recommended by component, pipe and sealant manufacturers and in accordance with accepted industry practices.

c Use plastic components with male threads and metal components with female threads where connection is plastic-to-metal.

F. Thrust Blocks:

1. Use cast-in-place concrete bearing against undisturbed soil.

2. Size, orientation and placement will be as shown on the installation details.

3. Wrap fitting with plastic to protect bolts, joint, and fitting from concrete.

4. Install rebar with mastic coating as shown on the installation details.

G. Joint Restraint Harness:

1. Install harness in the manner recommended by the manufacturer and in

accordance with accepted industry practices.

2. Use restrained casing spacers for gasketed pipe routed through sleeving. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices. Install self-restraining casing spacers at all gasketed pipe bell joints and every 10-feet along the gasketed mainline pipe installed through sleeving. Provide correct number and type of restraints per manufacturer's requirements.

3.6 INSTALLATION OF MAINLINE COMPONENTS

A. Backflow Prevention Assembly:

1. Install backflow prevention device per manufacturer's recommendations where indicated in the drawings.
2. Provide assembly so that its elevation, orientation, access, and drainage conform to manufacturer's recommendations and applicable health codes.
3. Provide other valves, fittings, pipe supports as indicated on the drawings.

A. Isolation Gate Valve Assembly:

1. As presented in the installation details, per manufacture's instructions.
2. Install where indicated in the irrigation plans.
3. Connection to existing 12-inch PVC mainline pipe:
 - a Install tapping sleeve per manufacturer's instructions.
 - b Connect isolation gate valve directly to flanged outlet of tapping sleeve.
4. Brand "GV" in 2-inch high by 3/16-inch deep letters on valve box lid.

B. Air/Vacuum Relief Valve Assembly:

1. As presented in the installation details, per manufacture's instructions.
2. Install where indicated in the irrigation plans.
3. Brand "AV" in 2-inch high by 3/16-inch deep letters on valve box lid.

C. Quick Coupling Valve Assembly:

1. As presented in the installation details, per manufacture's instructions.
2. Install where indicated in the irrigation plans.
3. Brand "QC" in 2-inch high by 3/16-inch deep letters on valve box lid.

D. Flower Watering Station Hydrant Connection Assembly:

1. As presented in the installation details, per manufacture's instructions.

2. Sequence of construction:

- a Coordinate exact location with Contractor Officer Technical Representative.
- b Components up to and including Copper Type 'M' pipe are to be installed before concrete components. After concrete components is finished, complete installation of remaining components. Coordinate installation with concrete contractor.

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3. Location:

- a Stations will be installed at locations indicated on drawings, centered between adjacent sprinkler locations.
- b Route adjacent piping around stations. No mainline or lateral pipe is to be installed under Flower Watering Stations.
4. Paint "FW" in 2-inch high letters on valve box lid.
5. Attach "Do Not Drink" sign to hydrant.

3.7 INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS

A. Remote Control Valve Assembly:

1. Mainline Flushing:

- a Thoroughly flush mainline before installation of Remote Control Valve Assemblies.
 - b Identify remote control valve service tee(s) to be used for mainline flushing. Plug service tees not being used for flushing.
 - c Connect 2-inch pipe to flushing service tee(s). Use pipe to direct water away from trench and into drainage swale, curb section or storm sewer, i.e. to an area that will direct the water away from the work area. Direct water so that it does not disrupt the cemetery operations.
 - d Use a volume of water such that the velocity in the largest pipe flushing to this point is 3 FPS.
 - e Multiple points may be flushed simultaneously.
 - f Flush for a minimum of 20 minutes. Continue flushing until the water is clear of any and all debris.
 - g Contracting Officer's Technical Representative will review the flushing operation and clarity of water before stopping the flushing operation.
 - h Disconnect pipe from service tee(s) and install remote control valve(s).
2. Install per manufacturer's recommendations where indicated on the drawings.
3. Adjust valve to regulate the downstream operating pressure to 70 PSI for rotor sprinklers, 45 PSI for rotating stream nozzles and 35 PSI for spray sprinklers.
4. Wire connectors and waterproof sealant will be used to connect decoders or control wires to solenoid wires. Install connectors and sealant per the manufacturer's recommendations.
5. Install only one remote control valve to a valve box. Locate valve box 5-feet from and align square with nearby edges of paved areas.
6. Attach ID tag with station number to control wiring at solenoid.
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7. Brand two-wire cable leg number and station number in 2-inch high by 3/16-inch deep letters on valve box lid.

B. Large Turf Sprinkler Assembly:

1. Thoroughly flush mainline before installation of assembly. Water must be clear of any debris before flushing operation stops.
2. Install per installation details at locations shown on the drawings.
3. Locate sprinklers in water alleys per Water Alley Sprinkler Placement Detail.
4. Align sprinklers with location of upright monuments per installation detail.
5. Install sprinklers perpendicular to the finish grade.
6. Install swing joint with the appropriate angle between the lateral pipe and the lay length nipple per the installation details.
7. Wire connectors and waterproof sealant will be used to connect decoders or control wires to solenoid wires. Install connectors and sealant per the manufacturer's recommendations.
8. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
9. Adjust the radius of throw of each sprinkler for best performance.

C. Pop-Up Rotary Sprinkler Assembly:

1. Thoroughly flush lateral pipe before installing sprinkler assembly. Water must be clear of any debris before flushing operation stops.
2. Install per the installation details at locations shown on the drawings.
3. Allow 6-inch separation between side of rotary sprinkler and adjacent

edges of paved areas, walls or fences.

4. Install sprinklers perpendicular to the finish grade.
5. Install swing joint with the appropriate angle between the lateral pipe and the lay length nipple per the installation details.
6. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
7. Adjust the radius of throw of each sprinkler for best performance.
8. Install 2-foot square piece of sod around all rotary sprinklers in areas to be seeded.

D. Pop-Up Spray Sprinkler Assembly:

1. Thoroughly flush lateral pipe before installing sprinkler assembly. Water must be clear of any debris before flushing operation stops.
2. Install per the installation details at locations shown on the drawings.

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3. Allow 3-inch separation between side of rotary sprinkler and adjacent edges of paved areas, walls or fences.
4. Install sprinklers perpendicular to the finish grade.
5. Install swing pipe per the installation details. Use spiral barb fittings. Install pipe and fittings as recommended by manufacturer.
6. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
7. Adjust the radius of throw of each sprinkler for best performance.

E. Below Grade Tree Bubbler Assembly:

1. Thoroughly flush lateral pipe before installing assembly. Water must be clear of any debris before flushing operation stops.
2. Install per the installation details at locations shown on the drawings. Supply appropriate bubbler.
3. Install assembly perpendicular to the finish grade.
4. Install swing pipe per the installation details. Use spiral barb fittings. Install pipe and fittings as recommended by manufacturer.

3.8 INSTALLATION OF CONTROL SYSTEM COMPONENTS

A. Central Control System:

1. The location of the central control computer and weather station as depicted or described on the drawings is approximate; the Contracting Officer Technical Representative will determine the exact location during sprinkler layout review.
2. Install and test central control components including microcomputer, printer, computer peripherals, interface components, communication cabling, electrical connections, and other communication hardware per manufacturer's recommendations and the Acceptance Test.
3. Electrical connections to the central control system are to be completed by control system manufacturer's trained representative.
4. Install all exposed cable in conduit.
5. Install cable to antenna as directed by Contracting Officer Technical Representative.
6. Grout and seal all penetrations into Administrative Complex.
7. Create and program each central control unit with a "grow-in" program to establish turf in areas disturbed by construction.

B. Decoder Interface Unit:

1. Location of unit as depicted or described on the drawings is approximate; the Contractor Officer Technical Representative will determine the exact location prior to installation.

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2. Install and test electrical connections between central control unit components and decoder interface unit per control system manufacturer's recommendations.

3. Electrical connections are to be completed by control system manufacturer's trained representative.

C. Decoder Units:

1. Install decoders at locations shown in the drawings per the construction documents.
2. Install electrical connections per control system manufacturer's recommendations.
3. Install line surge protection and grounding rods at spacing recommended by control system manufacturer. Drive grounding rod into soil its full length. Connect grounding wire to rod and plate using CADWELD connections.
4. Label wires with the identification number (see drawings) of the remote control valve to which the control wire is connected.

D. Communication Cable

1. Route as directed on plans. Install with minimum number of field splices.
2. Install cable using open trenches. Use of vibratory plow is not permitted.
3. Carefully backfill around cable to avoid damage to wire insulation or wire connectors.
4. If cable must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in separate 12-inch standard valve box with black lid. Coil 3-feet of cable in valve box. Brand "WS" in 2-inch high by 3/16-inch deep letters on valve box lid.
5. Install cable parallel with and below mainline pipe unless noted otherwise on plans.
6. Install cable not installed with PVC mainline pipe in conduit.

E. Control Wire:

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape or zip-ties spaced at 10-foot intervals.
2. Control wiring may be chiseled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling and wire installation. Appropriate chisel must be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth must equal minimum cover previously listed.
3. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote control valve box.
4. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted.
5. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in turf areas using a valve box that contains an irrigation valve assembly, or in a separate valve box. Use same procedure for connection to valves as for in-line splices. If a separate valve box is used for wire splices, brand "WS" in 2-inch high by 3/16-inch deep letters on valve box lid.
6. Unless noted on plans, install wire parallel with and below mainline pipe.
7. Protect wire not installed with PVC mainline pipe with a continuous

run of warning tape placed in the backfill 6-inches above the wiring.

8. Cap all exposed wire ends with wire nuts.

F. Instrumentation:

1. Install per manufacturer's recommendations at location indicated on drawings.

2. Provide electrical connections between central control system hardware and weather station under direction and observation of central control system manufacturer's personnel.

3.9 INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts:

1. Prior to the Review at completion of construction, provide operating keys, servicing tools, spare parts, and any other items indicated on the drawings.

B. Other Materials: Install other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.

3.10 MAINTENANCE AND OPERATION INSTRUCTIONS

A. Irrigation System Maintenance:

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1. Prior to Final Inspection, provide two training sessions to operating personnel on proper operation and maintenance of the irrigation system. Training sessions should be for a period of not less than 4-hours each, scheduled on different days and cover aspects of maintaining, operating and repairing the new irrigation system components. Maintenance training session cannot be concurrent with central control system training sessions.

2. Unless otherwise noted, provide irrigation operation and maintenance information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed and labeled. Provide the following information:

a Catalog cut sheets for control system, valves, sprinklers, pipe and fittings, wire and wire connectors, ID tags, shop drawings, and all other irrigation equipment shown or described on the drawings and within these specifications.

b Manufacturer's Operation and Maintenance manuals.

c Manufacturer's Technical Service Bulletins.

d Manufacturer's Warranty Documentation.

e Recommended routine maintenance inspections for weekly, monthly and annual inspections, recommended actions for the inspections, recommended method for recording the findings of the inspections and proper winterization techniques.

f Predictive schedule for component replacement.

g Listing of technical support contacts.

3. Operation and maintenance submittal package must be complete prior to being reviewed by the Contracting Officer's Technical Representative. Incomplete submittals will be returned without review.

B. Control System Programming:

1. Create and program central control system with a peak season irrigation schedule for the areas being irrigated.

2. Using the precipitation rate results of the Distribution Uniformity tests calculate the peak season run time for each station.

3. Verify operation of program.

4. Prepare a memorandum documenting the details and assumptions of the programming. Turn over memorandum to Contracting Officer's Technical Representative. Completion of the memorandum is a prerequisite for final inspection and operational testing of the irrigation system.

3.11 Colored Controller Charts:

1. Prepare a map diagram showing location of all valves, piping, and route of the two-wire cables. Identify all valves as to size, ALNC - 915CM2003 32 84 00 - 34 PLANTING IRRIGATION station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
2. Include legend listing components used for the control system. Include a separate sprinkler table listing station number, sprinkler manufacturer and model, zone capacity, and number of sprinklers on each two-wire path.
3. Provide separate one colored full sized controller chart for each two-wire path.
4. Provide two sets of 11"x17" reduced colored charts of the actual "asbuilt" drawing. Chart must be readable at the reduced size so multiple sheets may be required.
5. Laminate one set of 11"x17" sized colored charts.
6. Place each 11"x17" set of charts in separate 3-ring notebooks intended for 11"x17" drawings.

3.12 PROJECT RECORD DRAWINGS

- A. The Contractor is responsible for documenting installed system and all changes to the design. Maintain on-site and separate from documents used for construction, two complete sets of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded on Project Documents.
- B. Record irrigation components, pipe and wiring network alterations. Record work that is installed differently than shown on the construction drawings. Special attention must be given to pipe routing and stationing.
- C. At completion of installation, Contractor must hire a Professional Licensed Surveyor to survey/document locations of all sprinklers, irrigation components enclosed within a valve box, flower water stations, wire splice boxes and "coordination points" and at internals of every 100-feet if there is not a valve box within that distance. If necessary, Contractor must flag sprinklers for Surveyor. Surveyor must use "SPR" as attribute data for sprinklers, the branding in the valve box lid (for example "GV", "AV", "QC") as the attribute data for components enclosed within a valve box, "FWS" for flower water station, "WS" for wire splice boxes and "CP" for coordination points. Contracting Officer's Technical Representative will provide AutoCAD file for Surveyor showing coordination points to produce "Survey Drawing". Surveyor is to use the AutoCAD files to develop and provide an AutoCAD file of the Survey Drawing.
- D. Prior to project completion, Contractor must provide the project redline drawings and the "Survey Drawing" AutoCAD files to Contracting Officer's ALNC - 915CM2003 32 84 00 - 35 PLANTING IRRIGATION Technical Representative for delivery to Engineer. Engineer will prepare "Record Drawings" by compiling the information on the Contractor redlines drawings and the "Survey Drawing". Provision of this information prerequisite for Final Inspection.

3.13 WINTERIZATION AND SPRING START-UP

- A. Winterize the new irrigation system in accordance with local practices in the first fall after completion of construction of the irrigation system and start up in the first spring after completion of construction. Repair any damage caused in improper winterization at no additional cost to the Owner. Coordinate the winterization and start-up with the cemetery landscape maintenance personnel.

3.14 MAINTENANCE

A. Operate and maintain irrigation system for a duration of 30 calendar days from Final Inspection. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.

3.15 CLEANUP

A. Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish. Restore site to normal or original condition.

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