



TECHNICAL SPECIFICATIONS

for

AUTOMATIC IRRIGATION SYSTEMS

Standard Details are Available Online at

http://plano.gov/Departments/Engineering/Pages/manuals_forms.aspx

Revised 12/29/2010

Always contact Field Services before work begins
Matt Simmons (214) 629-3673 or Troy Gibbs (214) 728-5777

Note: All required observations are detailed on page two, section 1.07.
Do not backfill any portion of the irrigation without inspection and approval from Field Services.

- All irrigation installations and repairs are to be made under the direct supervision of a licensed irrigator or irrigation technician (TCEQ 344).
- Do not begin construction of the irrigation system without having the meter taps installed.
- Read and fully understand the irrigation standard details and technical specs.
- Do not deviate from the details without the written consent of field services or designee. All changes must be initialed, signed, dated, and noted on plan.
- If you are unsure about any of the provisions in these specifications, contact a representative from Field Services for clarification. This may require an onsite meeting.

TECHNICAL SPECIFICATIONS
FOR
AUTOMATIC IRRIGATION SYSTEM
Section 02810

1.0 GENERAL:

The requirements of the "Construction Agreement" shall apply to all work of this Section with the same force and effect as though repeated in full herein. These specifications are to be used in conjunction with, and reference to, City of Plano Irrigation Standard Details and drawings.

1.01 Scope.

The work consists of the installation of a complete underground irrigation system as shown on the drawings and as specified hereafter. The Contractor performing this work shall furnish all labor, equipment, materials, and permits, and perform tests necessary for the completion of the system. No sub-contractors are to be used except those specified to be furnished by others in the plans. The Contractor shall restore the site to the original condition. Work hours shall be limited to Monday-Friday, 8:00 a.m. to 5:00 p.m., unless otherwise approved by the Contract Administrator or designee.

1.02 Protection of existing utilities.

The Contractor shall be responsible for locating all cables, conduits, piping, irrigation system, and any other utilities or structures that may be encountered either above or below ground. This includes, but is not limited to, trees, ornamentals, and turf grass. All necessary precautions must be taken by the Contractor to prevent any damage to these existing improvements. In the event that such damage should occur from the Contractor's operations, the Contractor shall repair or replace or bring to original condition the damaged utilities or improvements at the Contractor's expense.

1.03 Rock

If the Contractor encounters rock or other unfavorable trenching conditions, no additional compensation will be paid. When material from the excavation or trenching is unsuitable for use as backfill, additional backfill material suitable for this purpose shall be brought in at the expense of the Contractor. It shall also be the Contractor's responsibility to remove and legally dispose of all unsuitable materials removed from the trench that cannot be used in the backfill operation.

1.04 Safety

Vendor shall provide all required safety signage, barricades, and flashers/strobes. All employees shall have proper safety devices and equipment, including *safety*

vests with company name, and hearing and eye protection. All equipment and personal protective equipment shall meet OSHA and TXDOT safety standards. Warning signs and barricading shall be in accordance with all local, state and/or federal laws. If a vendor is discovered working without necessary safety devices or equipment in place, they will be required to stop all work in progress. Vendor will not be allowed to return to work until adequate safety equipment and/or devices are in place.

In addition, all open trenches or pits that are unattended should be flagged in their entirety. Installed valve boxes shall remain securely closed unless Contractor is rendering work to the box. And if traffic, vehicular or otherwise, is affected, Contractor shall submit a complete traffic control plan.

1.05 Park use

At no time, other than for direct work, shall equipment or vehicles be parked on the park site other than in designated parking areas.

1.06 Equipment Condition

All equipment used on job sites shall be kept in good and safe operating condition at all times. Equipment repairs or service of equipment, such as routine maintenance, will not be allowed on Owner's property unless necessary to restore equipment mobility.

The following observations shall be the *minimum* required during the course of construction. Additional observations shall be made at any time at the discretion of the Owner. It shall be the responsibility of the Contractor to notify the Owner in writing (via email) 48 hours in advance of each required observation. The sequence of required observations shall not be changed from the sequence listed below. The Contractor shall not proceed with work in the next sequence without written acceptance of the previous sequence. Payment will not be approved for items that have not been observed and approved in writing.

1.07 Required observation (system inspections)

The following observations shall be the *minimum* required during the course of construction. Additional observations shall be made at any time at the discretion of the Owner. It shall be the responsibility of the Contractor to notify the Owner in writing (via email) 48 hours in advance of each required observation. The sequence of required observations shall not be changed from the sequence listed below. The Contractor shall not proceed with work in the next sequence without written acceptance of the previous sequence. Payment will not be approved for items that have not been observed and approved in writing.

1.071 Staked locations of mainline, valves, and irrigation heads.

1.072 All pipe runs and joints including any coupling or bell end connections.

- 1.073** All wire installation.
- 1.074** All thrust blocks must be exposed for visual observation.
- 1.075** Pressure test of mainline and electric control valve installation.
- 1.076** Irrigation head and tree spray head placements, coverage and operating pressure
Prior to planting
- 1.077** Automatic controller installation and operation.
- 1.078** Irrigation head and tree spray head placements, coverage and operating pressure
Prior to planting

1.08 Subcontracting

No portion of the work shall be subcontracted without prior written consent of the City. In the event that the Contractor desires to subcontract some part of the work specified herein, the Contractor shall furnish the City of Plano with the names, qualifications and experience of their proposed subcontractors. The Contractor shall, however, remain fully liable and responsible for the work to be done by its subcontractor(s) and shall assure compliance with all requirements of the contract.

2.0 MATERIALS:

2.01 General.

- 2.011** All materials shall be new and without flaws or defects of any type. All materials shall have a minimum guarantee of one year against material defects or defective workmanship.
- 2.012** All materials shall be of the brands and types specified in City of Plano standard details.
- 2.013** The irrigation system was designed around equipment manufactured by specific companies as a standard. There are “no approved equals” for any of the materials specified. Vendor will be required to submit a complete list of all materials to be used in the installation within 5 days of award.

2.02 Pipe

- 2.021** Polyvinyl Chloride Pipe (PVC) shall be rigid un-plasticized PVC extruded from virgin parent material of the type specified, being homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles, or dents, and shall have been manufactured in accordance with the commodity standards procedures of the Department of Commerce.

**Technical Specifications
Automatic Irrigation System**

- 2.022** Irrigation pipe downstream of master valve shall be class 200 PVC for sizes ¾” and up.
- 2.023** All PVC pipe shall be continuously and permanently marked with the manufacturer’s name or trade mark, size, schedule, type, working pressure at 73 degrees F., SDR number, products standard number and National Sanitation Foundation (NSF) approval.
- 2.024** All lateral line pipes shall be solvent welded. “Ring-and-gasket” pipe may be used with owner’s approval for main lines 4” and above only if AWA mechanical joint fittings and proper blocking are used on all directional changes (**see SD-04 “thrust blocks”**).
- 2.025** Solvent welded pipe fittings shall be molded fittings, Schedule 40, manufactured of the same material as the pipe, and shall be suitable for solvent weld slip joint ring, tight seal or threaded connection.
- 2.026** Copper pipe or tubing shall be type K” for pipe installed downstream of irrigation meter to the master valve. Use straight lengths of domestic manufacturer only.
- 2.027** All copper pipe fittings shall be sweat-type fittings of domestic manufacturer.

2.03 Cements, cleaners/primers, and joint compounds.

- 2.031** Cement shall be clear plastic pipe cement for use on all sizes and schedules of PVC pipe and fittings. Cement must be NSF approved and meet ASTM D 2564 specifications.

Note: Colored glue is to be used for any reason to ensure primer is visible during inspection.

- 2.032** PVC pipe and fittings shall be primed with a colored primer prior to applying the PVC cement in accordance with the Uniform Plumbing Code (Section 316) or the International Plumbing Code (Section 605).
- 2.033** All threaded connections between PVC and metal pipe shall be made using teflon tape only.
- 2.034** All metal to metal connections shall be made using teflon tape. All PVC to PVC threaded connections shall use teflon tape.

2.04 Wire splicing materials (See SD-02, 03, and 09)

All wire splices shall be made watertight using either **Wade WC-014, 3M DBY/DBR, or Tom King “black” LV9500**, splice connectors. All wiring installed under sidewalks, roadways, parking lots, etc., shall be installed in a Class 200 PVC sleeve. The sleeve shall be sized to allow for easy installation or removal of the wire.

Note: Wire should not be run in the same sleeve as a main or lateral line. (SD-10)

2.05 Other miscellaneous fittings and materials.

All other miscellaneous fittings and materials shall be as specified on the drawings. If not specified on drawings, adhere to the manufacturer’s recommendations.

3.0 SUBMITTALS AND RECORD DRAWINGS:

3.01 Submittals.

Submittal information shall be the manufacturer’s cut sheets submitted on all controllers, heads, backflow preventers, valves, valve boxes, pipe, and fittings.

3.02 Record drawings.

3.021 The Contractor shall provide and keep up-to-date a complete set of record drawings which shall be corrected daily to show all changes in the location of irrigation heads, controllers, backflow preventers, valves, drains, meters, points of connection, wire splice points, pipe and wire routing and other changes that may have been made from the original drawings and specifications. All gate valves, manual drains, wire splices, automatic and manual valve locations, controllers, power supply, and mainline piping shall be shown with actual triangulated measurements to reference points so they may be easily located in the field.

3.022 At the time of final acceptance, the Contractor shall furnish a reproducible record drawing prepared showing the entire completed system as actually installed. The Contractor shall provide a legible reduction of the drawings, laminated in plastic as well as a high resolution digital scanned copy.

4.0 PREPARATION AND INSTALLATION OF THE IRRIGATION SYSTEM:

4.01 General.

4.011 This section includes installation specifications for all items installed as a part of the irrigation systems. Certain construction procedures or minor equipment installation procedures may have been omitted from these specifications. If no specification, detail or plan provides adequate instructions for installation, the Contractor shall install per the manufacturer’s recommendation.

4.012 Either a licensed irrigator or a licensed irrigation technician shall be on-site at all times while the landscape irrigation system is being installed. When an irrigator is not on-site, the irrigator shall be responsible for ensuring that a licensed irrigation technician is on-site to supervise the installation of the irrigation system. The Owner may demand that work stop until the Contractor provides for a Licensed Irrigator or Licensed Irrigation technician to be present at the project site and supervising all irrigation work.

4.013 A pre-construction site observation will be conducted prior to construction to observe conditions and note features which may be considered inoperable or have prior damage.

Note: A site visit affidavit may be required.

4.014 Irrigation plans are *diagrammatic due to scale*. Significant system modification may be required by field conditions. Written consent from Owner's representative is necessary to make such changes. In no situation shall the Contractor install valves or heads under or in concrete paving areas. In any situation that the plans show a conflict in the actual site conditions, it shall be the Contractor's responsibility to notify the Owner of the conflict to receive direction. Irrigation work shown on the drawings within tree dripline areas is not diagrammatic, and must be constructed exactly as shown on the drawings.

4.02 Product handling.

The contractor shall be responsible for correct procedures in loading, unloading, staking, transporting, handling, and legally disposing of all materials according to manufacturer's specifications to be used in the irrigation system. The Contractor shall avoid rough handling which could affect the useful life of equipment.

4.03 Excavation and trenching (See SD-10)

4.031 The Contractor shall stake out the location of each run of pipe and all irrigation heads and valves prior to trenching (**see 1.071**). Each run of the system shall be approved by the Owner before actual installation is started. Prior to trenching, the Contractor shall contact line location services to spot all utility lines.

4.032 Excavation and trenching for pipelines shall be true to line with vertical trench banks. The width of the trenches shall not be greater than necessary to permit proper jointing, tamping, backfilling, bedding or any other installation procedures that may be necessary.

4.033 Trench depths shall be sufficient to provide the specified pipe cover as described elsewhere in these specifications or as noted on the drawings. **In rocky areas, the trenching depth shall be six (6) inches below normal trench depth to allow for pipe bedding as described in other portions of these specifications.**

4.034 There shall be a minimum of 18 inches and a maximum of 20 inches of cover from proposed grade to top of pipe for all pipe functioning as mainline, and a minimum of 12 inches of cover from the proposed grade to the top of all pipe functioning as lateral lines.

4.04 Pipe and fittings.

4.041 Installation of plastic pipe and fittings shall be in accordance with the specifications list within. When specifications do not clearly depict the scope, install per the manufacturer's recommendation.

4.042 Caution shall be exercised by the Contractor in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be stored and transported in a vehicle with a bed long enough to allow the pipe to lie flat without subjecting it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged or in any other way found to be defective, either before or after placing in the trench, shall be replaced with sound pipe without additional expense to the Owner.

4.0421 Irrigation system components shall only be stored in areas designated by owner in writing.

4.043 Before installation, the inside of the pipe shall be cleaned of all dirt and foreign matter and shall be kept in a cleaned condition during and after laying of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other foreign substances will enter the pipe or fittings. Where pipe ends are left for future expansion or connections, they shall be valved and capped, as directed on the drawings.

4.044 All PVC pipe and fittings shall be assembled to permit the pipe or fittings to be joined at the true parallel position of the fitting. Placement of pipe in curving trenches that causes bending and stress on pipe and fittings will not be permitted. No excess piping or fittings shall be permitted in the installation of the system, which may increase pressure loss or potential blockage.

4.045 Excavation and trenching shall be true to line and at the width and depth specified in other sections of these specifications. **Before installing the pipe, all rubbish and rocks shall be removed from the trenches. If the soil is extremely rocky, the trenches shall be padded with dirt or sand.** Material used for pipe padding shall be approved by the Owner. The full length of each section of the pipe shall rest solidly upon the pipe bed.

4.046 Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work. Any water that may be encountered or may accumulate in the trenches

or excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the trench or excavation free and clear of water during the progress of the work.

- 4.047** PVC pipe will expand or contract at the rate of one (1) inch per 100 feet per 10 degrees F change in temperature. Therefore, the pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
- 4.048** When more than one pipe is installed in the same trench, a four (4)-inch separation shall be maintained at all times.
- 4.049** After all irrigation piping, risers, valves, thrust blocks, etc., have been installed and partially backfilled as specified in other parts of these specifications, the control valve shall be opened and a full head of water used to flush out the system. After the system is thoroughly flushed, risers shall be capped off and the system pressure tested in accordance with the testing section of these specifications. At the conclusion of the pressure test, the heads shall be installed and the backfill operation completed.

4.05 Solvent welding procedure.

Solvent cement should only be stored and used when temperatures are between 40 and 110 degrees Fahrenheit. Solvent welding should be performed to manufacturer's specification taking care to leave clean joints. "Jelly like" solvent cement is not to be used under any circumstance.

4.06 Backfilling

- 4.061** Upon completion of a particular section of the irrigation system, and after sufficient time has elapsed for the curing of solvent weld joints, partial backfilling can begin if inspection has occurred and owner's representative has approved. Only the sections approved can be backfilled. If a hydrostatic test is required, all joints, risers and connections shall remain exposed for visual observation during the hydrostatic test. After completion and acceptance of the hydrostatic test for a particular section of the irrigation system, the backfill operation can be completed if owner's representative has approved.
- 4.062** All backfill material shall be subject to approval by the Owner. Backfill material shall be free from rubbish, rock, large stones, brush, sod, frozen material or other unsuitable substances that may damage pipe during the backfilling operations.

4.063 In the event that the material from the excavation or trenching is found to be unsuitable for use in backfill, it shall be removed from the site and properly disposed of by the Contractor and at the Contractor's expense. The Contractor shall then, at no additional cost to the Owner, arrange for, purchase, and furnish suitable backfill material consisting of earth, loam, sandy clay, sand, or other approved materials free of large clods of earth or sharp stones.

4.064 In rocky areas the depth shall be six (6) inches below the normal trench depth to allow for six (6) inches of suitable backfill as padding for the pipe. In like manner, there shall be at least six (6) inches of padding on either side of the pipe as padding against the rock wall of the trench.

4.065 Backfill shall be placed in horizontal layers, "lifts" not exceeding six (6) inches in depth and shall be water-packed. After the soil dries, it should be rolled. Backfill shall be placed to the limits the installer feels that total settlement in three (3) months shall be flush to finish grade. If settlement of trenches below finished grade occurs any time within the one-year warranty period, it shall be the Contractor's responsibility to refill trenches and to re-establish a permanent turf in the repaired areas. The Contractor shall be notified in writing of areas that have settled, and the Contractor shall fix the settled ditches within five (5) working days.

4.07 Sleeved crossing (SD-08)

4.071 Unless otherwise noted on drawings, all piping installed under sidewalks, roadways, parking lots, etc., shall be sleeved in a SCH 40 PVC pipe two sizes larger than the pipe to be sleeved. Wiring shall be placed in a separate sleeve from that of the pipe crossing and shall be two (2) inches or larger SCH 40 PVC.

4.072 Every effort shall be made by the Contractor to install sleeving prior to the pouring or construction of the sidewalks, roadways, parking lots, etc. If prior sleeving is not possible, all crossings must be bored unless written authorization for an open cut is obtained from the Owner.

4.073 All pipe and wire sleeves shall extend 1-2' beyond paving, concrete, median opening, and pavers.

4.08 Thrust blocks (See SD-04)

Thrust blocks shall be constructed at all direction changes and/or termination points for pipe 4" and above, or at any point of the system that will result in an unbalanced thrust. Thrust blocks shall be poured against undisturbed earth and in accordance with the drawings and details. Do not obstruct the outlets of fittings that are intended for future connections.

4.09 Irrigation heads (See SD-05)

- 4.091** Irrigation heads shall be the type and make specified and shall be installed to finished grade unless otherwise specified. Irrigation heads shall be installed a maximum of six (6) inches and a minimum of four (4) inches from curbs, walls, driveways, building walls, etc. Heads shall be installed in the vertical positions, hand backfilled, and compacted to near original density.

- 4.092** Irrigation head spacing shall not exceed the spacing shown on the drawings and shall be in the approximate locations and configuration as shown on the drawings. Contractor shall verify area dimensions while staking irrigation head locations. Irrigation heads shall be spaced so that they are equal distance from one another for the given lengths and widths of the area to achieve uniform coverage.

- 4.093** After all piping and risers are in place and connected, and before installation of the irrigation heads, all control valves for a given section shall be fully opened and a full head of water shall be used to flush out the system.

- 4.094** If water pressure without the heads installed is not sufficient to provide adequate water flow from end risers, the Contractor shall cap off enough heads closest to the water source to provide adequate flushing of the end riser assemblies.

4.10 Controller (See SD-07)

- 4.101** The controller location is indicated on the drawings. The Contractor must be familiar with the requirements of making power connections if an AC controller is required. A licensed electrician shall perform power installation for AC controllers.

- 4.102** The controller shall be mounted and wired according to the manufacturer's recommended procedures and as specified in these specifications and on the drawings.

- 4.103** Electric control valves shall be connected to controller in the numerical sequences as shown on the drawings. The Parks Field Services reserves the right to change the numerical sequencing of the valves during the installation process if it is deemed necessary or appropriate.

- 4.104** Controller shall be installed in a locking controller enclosure as specified on the drawings.

- 4.105** In situations where a computerized central controller system is utilized, the Contractor is responsible for providing and installing the flow sensor wires to the water meter or Arad valve, even in situations where the water meter assembly is provided by the Owner.

4.106 Contractor shall provide two blue wires for the pulse signal on the flow meter in addition to two green wires to be used as spares.

4.107 All controller wire installation must be done in accordance with manufacturer's specification.

4.11 Electrical control valves (SD-02 & SD-03)

4.111 All electric control valves shall have flow control and be of the type and size as indicated on the drawings and shall be installed where shown on the drawings, following the published recommendations of the manufacturer and in accordance with these specifications and drawings.

4.112 Any DC-powered system must provide DC latching solenoids at no additional cost the Owner. All **DC-powered systems** must be installed per manufacturer's specification.

4.113 The valve boxes shall be as specified in City of Plano standard detail

4.114 Valve wire splices shall be waterproofed using **either Wade WC-014, 3M DBY/DBR, or Tom King "black" LV9500** splice connectors, **part # LV9500**. The Contractor shall leave 24 inches of wire coiled to facilitate raising the wire out of the valve box for repairs.

4.115 Type K copper shall installed from the inlet side of the ball valve/master valve assembly back to the double check; and from the inlet side of double check back to the meter.

4.116 The contractor shall install **2 yellow wires for master valve and 2 black wires to be used as spare**. Both pairs of wires shall run from the master valve to the controller.

4.12 24 Volt control valve wiring.

4.121 All wire installation procedures as described herein shall be checked to conform to local electrical codes.

4.122 For AC controllers, all wire used for the 24 volt wiring from the controller to the electric control valves shall be type "UF", 600 volt, solid copper, single conductor, PVC insulated and bear UL approval for direct burial underground feeder cable. Unless otherwise specified on the drawings, the 24 volt common wires shall be white wire No. 12 AWG and the remaining 24 volt control wires shall be red No. 12 AWG. These colors shall be noted on the "as-built" record drawings.

- 4.123** The Contractor shall install the 24-volt control valve wiring in the same trench as the irrigation system mainline. In no situation shall the wire be installed above (i.e. on top of) the mainline. The wires shall be laid loose in the trench to allow for contraction. Control wires shall be taped together in 20'0" increments.
- 4.124** **No wire splices will be allowed in DC Systems**, other than at valve box locations. Wire splices in AC systems are allowed, but must receive prior approval from owner's representative and must be noted on the "as built" plans. If needed, they shall be made only at common splice points and placed in a standard double check valve box, reference **(SD-09)**. The location of these wire splice boxes shall be shown on the "as-built" record drawings. No buried wire splices shall be permitted. All wire splices shall be made waterproof using material specified in **section 2.04**.
- 4.125** **In no case shall wires of different colors be spliced together.**
- 4.127** All wiring shall be subsidiary to control valve installation.

Note: DC latching solenoids shall not exceed a distance of more than 800 feet from the controller.

4.13 120 Volt controller power wiring (AC Systems only)

- 4.131** **AC** Controllers requiring 120 volt wiring shall be installed in accordance with State and local electrical codes and regulations. The 120-volt service shall consist of one black and one white wire. The neutral wire must be bonded. All wiring is subsidiary to project.
- 4.132** If required, contractor shall provide and install 120-volt power to the controller location. A Licensed Electrician shall perform all high voltage electrical work.

4.14 Mainline manual drain valves

Manual drain valves of the size and type indicated on the drawings may be installed as necessary at low points of mainline piping, or at any other points that may be indicated on the irrigation system drawings.

4.15 Testing

If a hydrostatic test is required: Upon completion of the irrigation system's mainline, the entire mainline shall be tested for a six (6) hour period at existing static pressure. Prior to testing, the mainline shall be partially backfilled, leaving all joints and connections exposed for visual observation. All dirt shall be flushed from the system and the line filled with water to remove air. The mainline shall be brought to static pressure. The existing static pressure must be retained for a six (6) hour period. Any leaks resulting in the six (6) hour pressure test shall be repaired and the system retested until the system passes the test.

4.16 Maintenance

The Contractor shall maintain all plant material and turf within the construction area that is irrigated by the previously existing or newly installed irrigation system. All plant material and turf must be irrigated and maintained in a healthy state and mowed frequently according to the Park Maintenance directions. Temporary staging areas, earth graded areas, or material storage areas will require mowing only. The Contractor shall be responsible for all watering of plant material and turf through programming of the irrigation controller.

4.17 Adjusting of system

Upon completion of the installation, the Contractor shall adjust all heads and valves. It will be the **Contractor's responsibility** to program the controller and maintain the irrigation until 'Final Acceptance' of the project.

4.18 Clean-up

The Contractor shall continuously keep a neat and orderly area in which he is installing the system. Legal disposal of rubbish and waste material resulting from the installation shall be continual. Upon completion of the system, the Contractor shall remove from the Owner's property, all temporary structures, rubbish, waste material, tools, and equipment resulting from or used in the installation of the system. In no situations shall the Contractor use trash receptacles furnished by the Parks & Recreation Department for the public use.

4.19 Final acceptance.

4.191 When the Contractor is satisfied that the system is operating properly, that it is balanced and adjusted, that all work and clean-up is completed, the Contractor shall issue notice of completion to the Owner in writing, requesting a system review. The Owner shall respond within five (5) working days to the notice by the Contractor. At that time, the Contractor shall demonstrate the system in its entirety. In judging the work, no allowance for deviation from the original drawings and specifications will be made unless prior written approval has been obtained. This system review must be completed prior to beginning planting operations.

4.192 Any inconsistencies to the specifications shall be noted by the Owner and a written copy of corrections shall be given to the Contractor. Work not found to be compliant with the construction contract documents should be reworked by the Contractor until a subsequent review of work is found to be compliant with the contract.

4.193 When all fieldwork is found to be compliant with the construction contract documents, the Contractor shall provide to the Owner the following:

4.1931 All manufacturer's equipment manuals, diagrams, parts lists, and maintenance recommendations.

4.1932 Record drawings on reproducible sepia paper.

4.1933 **Reduced, laminated set of plans on 8 1/2" X 11" format to install in the controller.**

4.1934 **A high resolution digital copy of original and as built plans.**

4.20 **System maintenance and warranty.**

4.201 For a period of one **(1) year from final acceptance of the system**, the Contractor will promptly furnish and install, without cost to the Owner, all parts or materials which prove defective in material or workmanship. Damage due to irrigation system line breaks caused by defective material or workmanship shall be repaired and brought to original condition by the Contractor at no expense to the Owner. The Contractor shall complete all repairs within 24 hours of receipt of notification from the Owner of system failure.

4.202 Minor maintenance of the system shall be the responsibility of the Owner.

4.203 For a period of one (1) year from final acceptance of the system, the Contractor shall repair any settlement of the irrigation trenches back to its original condition.

4.204 Repair shall be completed by the Contractor within 48 hours after notification from the Owner of trench settlement problems.