

**SECTION 02810  
IRRIGATION SYSTEM**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. Perform all work required for design and installation of a new irrigation system and its operation including system design and all labor, materials, taxes, permits, insurance, overhead, profit, services, and equipment necessary as described herein. Refer to Landscape Drawings for site areas to be irrigated. New shrub bed plantings are to be irrigated with pop-up spray heads. Connect to existing OSU irrigation main line in location shown on plans, and connect new irrigation zone to existing irrigation controller as shown. For the existing OSU turf irrigation system in the area of the project, make needed adjustments as described on plans. Furnish shop drawings of proposed new irrigation plan, showing new shrub bed layout as well as existing turf heads and adjustments required.
  
- B. Work includes the installation of a completely automatic underground irrigation zone including:
  - 1. Excavation and backfill.
  - 2. Installation of the irrigation main line, lateral piping, automatic control valve, valve boxes, control and common wiring, sprinkler heads, quick coupler valve, and associated equipment.
  - 3. The Irrigation Contractor shall test, balance and adjust the various components of the system so that the overall operation is efficient. This includes adjustments to pressure regulators, flow controls, arc and radius adjustments to sprinkler heads, and individual station adjustments on the controller.
  - 4. Coordinate closely with Drawings and OSU facilities personnel and owner's landscape maintenance company for connection to existing irrigation line and existing irrigation controller. Existing irrigation features that are shown are approximate only, contractor is to field verify. Where new construction of brick wall and landscaping affects the existing irrigation system in the project area, make adjustments and modifications to the existing system to coordinate with new work. Repair and adjust existing piping and heads as needed that are impacted by new work to provide a fully functional / properly adjusted irrigation system.
  
- C. Related work in other Sections:
  - 1. Section 02950 – Landscaping

**1.2 REFERENCES**

- A. Meet requirements and recommendations of applicable portions of the Standards Listed.
  - 1. American Society for Testing and Materials (ASTM).
  
- B. Install the new sprinkler system according to applicable city ordinances and plumbing codes.

**1.3 SYSTEM DESCRIPTION**

Performance Requirements: Areas identified on the plan shall have 100% coverage. Any area lacking water shall be corrected at no additional expense to the Owner. Refer to Landscape Plan for limits.

#### **1.4 SUBMITTALS**

A. The successful bidder shall submit the following:

1. Irrigation layout plan: Submit detailed scale drawing showing main lines (if any), lateral lines, and valve and head placement. Owner / Owner's Representative shall review plan prior to start of installation. Provide sizes of all pipe and valves. Drawing shall be at a scale of 1"=10' on a sheet size of 24"x36". Contractor may obtain an as-built drawing of the existing irrigation system from OSU, and may request a CAD file showing new landscape work from landscape architect.
2. Manufacturer's Literature: information on all system components and any other pertinent information requested by the Owner or Landscape Architect (3 copies).
3. Do not begin construction work until shop drawings have been approved.
4. "As-Constructed" drawings: Showing accurate locations of controller, mains, valves, laterals and heads.

#### **1.5 SUBSTITUTIONS**

Equipment listed matches OSU's existing irrigation system – no substitutions will be allowed.

#### **1.6 WARRANTY**

All work by Irrigation Contractor shall be guaranteed by the installer against defects of material and workmanship for a period of one (1) year, beginning with the date of substantial completion.

#### **1.7 MAINTENANCE**

Furnish the Owner a complete set of tools. Provide one tool of each kind required to remove, maintain, or re-install spray heads.

#### **1.8 DESIGN CRITERIA / PERFORMANCE**

- A. Prior to installation of the irrigation system, the contractor shall verify water pressure at the site to determine available pressure. Contact True Green – Eric Hanson (918-271-0594) for assistance.
- B. The sprinkler system shall cover areas shown on the landscape drawings. The sprinkler system shall be completely underground and automatic, capable of providing complete coverage of the area to be irrigated.
- C. Irrigation system shall provide 100% coverage for all irrigated areas.
- D. Pipe sizes and valve sizes shall provide an economic and efficient system.
- E. In sizing lines allow for pressure loss due to valves, pipe and fittings, elevation change and all applicable factors. Flow velocities for all lines shall not exceed 5 feet per second. Pressure available at each head shall be at least the minimum specified by the manufacturer, and shall not exceed the maximum.
- F. For spray head zone, utilize pressure regulating valves, or pressure compensating nozzles.

## PART 2 - PRODUCTS

### 2.1 SPRINKLER SYSTEM

- A. Pipe: Static pressure mainline shall be Schedule 40 PVC pipe (ASTM 1785). Lateral lines shall be PVC Class 200 (ASTM D2241). Smallest pipe size shall be 3/4" PVC pipe.
- B. Fittings: PVC integrally molded during fabrication, solvent weld type, schedule 40. Bell and ring joints will not be integrally molded.
  - 1. Solvent welded fittings (non threaded) to be installed on the main line as well as on lateral lines (downstream of the electric control valve) shall be Schedule 40 dimensions and wall thickness and shall meet the requirements of ASTM Specification D 2466-78. Solvent cements and cleaner/primers used for welding PVC pipe and fittings shall meet ASTM Specification D 2564-80.
  - 2. PVC Schedule 80 solvent welded and Teflon pasted fittings and nipples shall meet ASTM D 2467 and ASTM D 2464 respectively and shall be used on all fittings required between the mainline tap and the electric control valve as well as the threaded connection between the electric control valve and the lateral piping.
- C. Valves:
  - I. Zone valves: Rain Bird PEB series.
- D. Sprinkler Heads:
  - 1. Shrub Spray Heads: Rainbird 1812 series (12" pop-up) with pressure compensating nozzles  
Nozzle pressure - 30 pounds minimum.
- E. Wire: 14 gauge UF. All splices shall be made using DBY water tight splice connectors by the 3M Company.
- F. Quick Coupler Valve: Quick coupling valve (Hunter HQ-3RC) shall be a one piece type, constructed of heavy cast brass. The self-closing cover shall be made of a durable, highly visible, rubber. The valve shall be opened and closed by a brass key of the same manufacturer having a 3/4" brass hose swivel permanently attached. Provide one key to Owner.
- G. Valve Box: Provide valve boxes for all remote control valves. The manufacturer shall be Highline, Plymouth Products Division, Sheboygan, WI, or approved equal. For a single valve use model #181104 – 10 inch round box with a twist lock cover.

## PART 3 - EXECUTION

### 3.1 TRENCHING

- A. **Locate all utilities prior to installation of the new irrigation system. Contractor shall be responsible for damage to utilities. Do not begin trenching until the existing fiber optics line in the project area has been field located.** Contact OSU facilities staff for assistance (Jeff Evans, ph. 918-594-8263 or Paul O'Neill, ph. 918-605-2637.)
- B. Dig trench of width adequate to install and connect piping.
- A. All static supply pipe shall have minimum cover of eighteen (18) inches above the top of pipe. All other pipe shall have a minimum cover of twelve (12) inches above the top of pipe.

### **3.2 LAYING PIPE**

- A. Square cut pipe with no burr ends. Wipe all dirt and moisture from fittings, apply solvent to both ends. Stab pipe into socket of the fitting and rotate one-half turn to spread solvent uniformly. Hold joint in place 15 seconds minimum, or until solvent is set. Do not disturb for 15 minutes or until the chemical weld is made. Do not use excessive solvent.
- B. Use PVC solvent joint to thread adapters. Do not thread PVC pipe to metal pipe or accessory.

### **3.3 VALVE PLACEMENT**

- A. All electric control valves shall be set at the depth of pressure piping and shall be equipped with a valve access box.
- B. Valves specified shall be placed in pre-cast boxes with a minimum of eighteen (18") inches of space between their top surface and the finished grade.
- C. Valve boxes shall be mounted flush and level with grade using extensions as required. No portion of the valve box shall rest on pipe or valve.
- D. Provide one quick coupler valve along the main line, in location that is shown on plans. The quick coupling valves shall be installed on PVC threaded swing joint on the irrigation mainline. Boxes shall be installed to a height that will not cause them to interfere with maintenance machinery and which is sufficient to prevent soil or mulch from washing into the box. Provide a 6 inch layer of washed gravel in the bottom of the valve box. Provide a 1"x1"x3' piece of angle iron next to the quick coupling valve and anchor with two (2) stainless steel hose clamps.

### **3.4 CONDUCTORS AND INSTALLATION IN TRENCHES**

- A. Conductors may be installed in the same trench as the water pipe.
- B. Sharp bends or kinks in the conductor shall not be permitted.
- C. Conductors shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench with a minimum cover of 12".
- D. Under no condition shall the cable be unreeled and pulled into the trench from one end.
- E. Splices shall be limited to the areas under the valve boxes.
- F. Neatly coil two (2') feet of cable slack at each valve solenoid connection within access boxes.
- G. Conductors shall be solid copper, insulated, and shall meet requirements of local codes and ordinances.

### **3.5 BACKFILLING**

- A. Backfill around the pipe shall be free of rocks and other debris, and care shall be taken that no rocks or other obstructions rest against the pipe.
- B. Backfill shall be undertaken so as to leave no depressions.
- C. Should depressions develop after completion of the work, the Contractor shall be responsible for adding additional topsoil or other work to correct these depressions.
- D. All supply (static) piping shall have minimum cover of eighteen (18) inches above the top of pipe. All other pipe shall have a minimum cover of twelve (12) inches above the top of pipe.

### **3.6 HEAD PLACEMENT**

- A. Set all lawn heads flush with finished grade. Allow for installation of sod.
- B. Pop-up spray heads shall be connected to the irrigation piping utilizing 1/2" thick walled polyethylene tubing (Toro model 850-05) and appropriate insert fittings (Toro models 850-31, 850-34 or 850-35). Sufficient lengths of flexible pipe shall be used to form a sweeping arc to insure that spray heads are supported properly and allow for vertical adjustment and movement during service.
- C. For rotary heads that are relocated, place heads three inches from edges of back of curb to allow for edging operations.
- D. Adjust the height of spray heads, as necessary and as directed by the Owner throughout the course of the installation.

### **3.7 FIELD QUALITY CONTROL**

- A. Testing: Upon completion of the installation, the entire system shall be tested and adjusted for proper operation and distribution of the system. Obtain complete coverage with wind velocity not more than six (6) mph.
- B. Pressure Testing:
  - 1. Flush piping clear of all dirt and foreign material.
  - 2. All tests on pressure lines shall be completed prior to final backfilling.
  - 3. Fittings and couplings must be open to visual inspection for the full period of test.
  - 4. Do no testing until the last solvent welded joint has set and cured for eight (8) hours.
  - 5. All control valves shall be closed.
  - 6. Sprinkler piping system shall be slowly filled with water to line pressure.
  - 7. Expel all air from piping before testing.
  - 8. Test duration: Four (4) hours. System shall be subject to full line pressure. Should any section of pipe laid indicate leakage, locate and repair defective pipe and joint and re-test.

### **3.8 DEMONSTRATION / ACCEPTANCE**

- A. Demonstrate operation of all new irrigation zones for the Owner / Owner's Representative. All irrigated areas are to have 100% coverage. Contractor shall add additional heads, as necessary, at no cost to the Owner. Adjust all heads as required for proper operation, alignment, elevation, radius, and arc. OSU's facilities staff and OSU's landscape maintenance contractor shall be present during the demonstration. The demonstration shall also include the existing OSU system turf zones in the project area to verify that they are fully functional and modified to match up with new wall and planting bed installation. Make any requested corrections.

### **3.9 CLEANING**

Contractor shall keep job site clean and free of debris resulting from installation and service. Upon completion of the work, remove debris, rock and surplus material from the site.

**END OF SECTION**

## **SECTION 02950 LANDSCAPING**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES:**

- A. Section includes:
  - 1. Perform all work required to complete the landscape installation and maintenance / warranty period including all labor, materials, taxes, insurance, overhead, profit, services, water, and equipment necessary as described herein and shown on the accompanying drawings.
  - 2. Work to include:
    - a. Trees, shrubs and groundcover installation.
    - b. Soil amendments, planting bed preparation and mulching.
    - c. Maintenance service through landscape acceptance and warranty.

#### **1.2 DEFINITIONS AND ABBREVIATIONS:**

The following terms will apply to these specifications:

- A. "B&B" indicates balled and burlap wrapped root system.
- B. "1 gal." indicates the standard one-gallon nursery container.
- C. "M.T." or "multi-trunk" indicates a tree with a specified number of trunks as called out on the plant list.
- D. "cal." refers to the caliper of the trunk at six (6) inches above the ground level for trunks of four (4) inches in caliper size or less.
- E. "o.c." means "on center" and refers to the spacing used between the center of one plant and the center of another.

#### **1.3 QUALITY ASSURANCE:**

- A. Plant names indicated comply with the latest edition of the American Standard for Nursery Stock published by the American Association of Nurserymen and the latest edition of Standardized Plant Names prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not listed in these publications conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.
- B. Comply with sizing and grading standards of the latest edition of American Standard for Nursery Stock. Any plant with irregular growth, weakness in structure of material, infestations or irregular coloration when planted will not be accepted.
- C. All plants shall be grown under the supervision of standardized nursery conditions.

- D. Stock furnished shall be at least the minimum size indicated. The root structure shall provide evidence that the plant has been grown in the container size specified.
- E. All plants and other products and materials to be supplied by the Contractor shall be subject to inspection and approval prior to their installation. Such inspections may be made at the site.

#### 1.4 SUBMITTALS

- A. The following material samples are required by the Landscape Architect for approval prior to installation:
  - 1. Back to Nature soil conditioner (large baggie sample).
  - 2. Fertilizer (manufacturer's literature).
  - 3. Mulch (Large baggie sample).
  - 4. Slow release watering bags (literature).

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis and name of manufacturer. Store in a manner to prevent wetting and deterioration. Store materials in areas of site as directed by Owner.
- B. Take all precautions customary in good trade practice in preparing plants for moving. Dig, pack, wrap, transport and handle plants with care to ensure protection against injury. Protect all plants from drying out. If plants cannot be planted immediately upon delivery, properly protect them with tarps, or in a manner acceptable to the Owner. No plant shall be bound with rope or wire in a manner that could damage or break the branches.
- C. Cover plants transported in open vehicles with a protective covering to prevent windburn.
- D. Provide dry, loose topsoil for planting bed mixes. Muddy topsoil is not acceptable.

#### 1.6 GUARANTEE

- A. All plants provided and planted by Contractor shall be guaranteed from initial installation through final acceptance, and for a 12 month warranty period that begins on the date that Final Acceptance is granted. Final Acceptance will be certified after all plants are in place in accordance with Contract Documents, and they have been inspected by Landscape Architect and all corrections have been made satisfactorily. Plants, including trees, which have partially died so that shape, size, or symmetry has been damaged, shall be replaced. Plants that are not in healthy, growing condition shall be replaced. In all cases, the opinion of the Owner's Representative shall be final.
- B. Plants used for replacement shall be of the same variety as those originally specified and planted in the same condition. Replacement plants will be at least the same overall size of the adjacent plants at the time of replacement. All work, including materials, labor and equipment used in replacements, shall be at no cost to the Owner. Any damage, including ruts in lawn or bed areas, incurred in making replacements shall be immediately repaired by the Contractor.
- C. The above guarantee does not apply to theft, fires or malicious injury.
- D. At end of the warranty period, inspection will be made by Owner or Owner's Representative. Any plant that is dead or not in healthy, growing condition, as determined by the Owner, shall be removed from site. These and any plants missing due to the contractor's negligence shall be replaced as soon as conditions permit during the normal planting season, at no additional cost to

the Owner. All replacements shall be in compliance with construction documents. Once replacements are made, notify Owner for reinspection and end of contractor's responsibility for warranty.

## **1.7 MAINTENANCE**

- A. During planting operations, the Contractor shall perform all maintenance required of the installed plantings. Maintenance by contractor is to continue until completion and Final Acceptance. After Final Acceptance of all plantings, the Owner will be responsible for maintenance.

## **1.8 WATERING**

- A. Water for initial installation is to be provided at the contractor's expense. Hose and other watering equipment required for the work shall be furnished by the Contractor installing the plant materials. For the planting bed, utilize new shrub bed irrigation system.

## **1.9 CLEAN-UP**

- A. During the work progression, the premises are to be kept neat and orderly at all times. Storage areas for plants and other materials shall be so organized that they, too, are neat and orderly. All trash, including debris resulting from removing weeds or rock from planting areas or planting plants shall be removed from the site daily as the work progresses.

## **1.10 INSPECTION FOR ACCEPTANCE**

- A. Inspection of the plantings to determine completion of the specified work will be made by the Owner upon notice from Contractor. Inspection shall be requested only after all plant materials are in place in accordance with construction documents.
- B. After inspection, the contractor will be notified in writing by the Owner of any work that is not in accordance with plans and specifications. Reinspections will be held as required until all work is satisfactory. In all cases, the opinion of the Owner's Representative shall be final.

## **1.11 COMPLETION OF WORK**

- A. Work shall be considered complete and eligible for acceptance only after fulfillment of the contract requirements as per drawings and specifications.
- B. All materials shall be installed according to specifications. In all cases, the opinion of the Owner's Representative shall be final.

## **PART 2 - PRODUCTS**

### **2.1 PLANT MATERIAL**

- A. Provide plants typical of their species or variety with normal, densely developed branches and vigorous fibrous root systems complying with the recommendations and requirements of ANSI Z60.1 "Standard Nursery Stock" as specified. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sun scald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all other forms of infestation. All plants shall have a fully developed form without voids and open spaces.
  - 1. Balled and burlapped plants shall have firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery



of the plant. Provide ball sizes complying with the latest edition of American Standard for Nursery Stock.

2. If there is no specification listed, the following guide shall be used: Tree root balls shall be a minimum of 12" in diameter for each 1" of trunk diameter as measured 6" above ball.
3. Multi-trunk (M.T.) trees shall be calibrated according to the following: the smallest trunk caliper shall not be less than one caliper size smaller than the largest trunk with the number of trunks specified (refer to American Standard for Nursery Stock).
4. Container-grown stock should be grown in a container for a sufficient length of time for the root system to have developed to hold its soil together.
  - a. No plants shall be loose in the container.
  - b. Container stock shall not be pot bound.
5. Plants larger than those specified in the plant list may be used. If the use of larger plants is acceptable, increase the specified spread of roots or root ball in proportion to the size of the plant.
6. The height of all trees shall be measured from the crown of the roots to the top of the highest branch and shall not be less than the minimum size designated in the plant list.
7. Trees planted in rows shall be matched in form.

## **2.2 SOIL PREPARATION MATERIALS**

### **A. Organic Soil Amendment:**

1. Back to Nature (or Back to Earth) soil conditioner.

### **B. Tree and Shrub Fertilizer:**

1. Roots Transplant 1-Step as manufactured by Lebanon Seaboard Corporation.

### **C. Herbicides:**

1. Round Up, or approved equal non-selective herbicide.
2. Treflan 5g, as manufactured by ElanCo Products in Indianapolis, Indian, or approved equal.

## **2.3 STAKING AND GUYING MATERIALS**

- A. Refer to details on Drawings for staking methods. Staking material shall consist of six (6) foot metal T-fence posts painted black.
- B. Guying material shall consist of 12 gauge galvanized wire and 1 ½" tree straps with grommets or approved equal.

## **2.4 SLOW RELEASE WATERING BAGS**

- A. Gator Bags: Tregator Slow-Release Drip Irrigation Watering Bags, 20 Gallon.

## 2.5 MULCH

- A. Wood Mulch: Shredded Hardwood mulch.

## 2.6 STEEL EDGING

- A. Steel Edging: Steel edging shall be heavy-duty, commercial grade 3/16" thick x 4" Ryerson Steel Edging, or approved equal. Color shall be green.

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. Examine proposed planting areas and conditions of installation prior to construction. Do not start planting work until unsatisfactory conditions are corrected. Do not begin landscape work until new brick wall and decomposed granite paths have been completed, including site lighting and all related underground utility work. For the new shrub bed, closely coordinate landscape work with new shrub bed irrigation system. Do not install shrub bed materials until irrigation system is complete and fully operational.
- B. **Verify the location of all utilities prior to landscape operations.**
- C. Coordinate with other contractors for access to site areas. Provide traffic control as required – do not interfere with public street traffic.

### 3.2 EXCAVATION

- A. The Contractor shall adhere to the following during excavation:
  - 1. **Protect existing utilities, walls, paving, and curbing from damage caused by landscaping operations.**
- B. The Contractor shall be familiar with the location and alignment of all existing utility lines and buried cables. The Contractor shall field check the location of utilities before installation of materials or plants. The Contractor shall be responsible for all damage resulting from neglect or failure to comply with this requirement. Hand excavate if required due to utilities.

### 3.3 PREPARATION

- A. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.
- B. Planting times and procedures shall be according to accepted practices. Planting shall be suspended when the natural ground is too wet, or the continuation of prevailing weather would cause unsatisfactory results.
- C. Locate plants as indicated. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until obstructions are corrected or alternate plant locations have been selected by the Owner's Representative. Do not block visibility of highway / street signage.

### 3.4 LANDSCAPE INSTALLATION

- A. Excavation of tree pits: Use sharp shovels to cut holes for trees. Tree pits shall be as shown on details on Drawings. Topsoil from excavation may be retained for backfill if soil is free of shale,

clay, subsoil, rock and debris. Remove all excavated shale, heavy clay, subsoil, rock and debris from site.

- B. Each tree shall receive six (6) cubic feet of 'Back to Nature' mixed evenly with the existing soil to be used as backfill. Apply Roots Transplant 1-Step at a rate of four (4) ounces per caliper inch of tree. Incorporate Roots Transplant 1-Step into the top three to four inches of soil backfill.
- C. Set trees in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. No filling will be permitted around trunks or stems. Backfill the pit with planting mixture. Do not use wet, muddy mixtures for backfilling.
- D. After balled and burlapped plants are set, mix planting soil around the bases of the root balls and fill all voids.
- E. Plant trees two (2) inches above finished grade.
- F. Thoroughly water all plants immediately after installation.
- G. Install one Gator Bag for each tree, per detail on plans and manufacturer's directions.
- H. For planting beds, do not install plant materials until all Bermuda grass and weeds have been eliminated from the planting beds. If Bermuda grass is actively growing, spray with Roundup to completely kill Bermuda grass in bed areas. Spray several times, as required, for a complete kill of the entire root system. If Bermuda grass is dormant or partially dormant, remove the entire root system of the Bermuda grass. Any soil that is removed in the process of removing the Bermuda grass root system is to be replaced with imported topsoil. Set steel bed edging as shown on the drawings. Place edging and use a 2 x 4 wood block to pound the edging and stakes into place. Areas where paint has been marred will need to be re-painted using a matching color.
- I. Remove all rocks, heavy clay, inorganic materials and debris from the top 10 inches prior to bed preparation. All planting bed areas shall receive a 10 inch thick soil mixture comprised of a 3" layer of Back to Nature soil conditioner roto-tilled to be mixed evenly with existing soil. Existing soil can be used provided rocks, heavy clay and other debris in topsoil are removed prior to use in planting beds. Thoroughly blend soil and the specified amendments until the planting soil is a smooth, even mixture. Incorporate Roots Transplant 1-step to all planting beds. Apply Roots transplant 1-step at a rate of 5 pounds per 100 square feet into the top 3" - 4" of soil. Plant material shall be watered immediately after installation. Do not work beds when in frozen or muddy condition.
- J. Adjacent to the brick wall, closely coordinate shrub locations with new sign wall uprights so that the lighting is not blocked by plants.

### **3.5 MULCHING**

- A. For all tree wells install specified bark mulch (3" thick layer). Remove all twine / rope from base of tree trunks prior to mulching. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finish surface.
- B. Mulch shrub beds with the required mulching material to a two-inch depth immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finish surface.

### **3.6 STAKING AND GUYING**

- A. Trees shall be staked within 24 hours of planting, per details on Drawings. Provide three six-foot long steel T-posts per tree.

- B. Tree straps shall be used at the trunk to prevent damage to the tree, per details.

### **3.7 SLOW RELEASE WATER BAG INSTALLATION**

- A. Install one Gator bag at each tree after trees have been mulched and staked.

### **3.8 PRUNING**

- A. Pruning shall be limited to the minimum necessary to remove injured twigs and branches. All pruning shall be done only after the plants have been transplanted at the site.
- B. Prune evergreen trees only to remove broken or damaged branches, and to remove lower branching from trunks of pine trees.

### **3.9 MAINTENANCE THROUGH FINAL ACCEPTANCE**

- A. Maintain plantings from initial planting through Final Acceptance.
- B. Maintenance through Final Acceptance shall include watering, weeding, and the application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.
  1. Reset settled plants to proper grade and position. Restore planting saucer and remove dead material.
  2. Correct defective work as soon as possible after deficiencies become apparent and weather permits.
  3. Water trees and plants within the first 24 hours of initial planting, and as needed for optimum growth.
  4. Remove weeds and grass from tree wells at least once a week. A contact herbicide may be used provided lawn and plants are not damaged.
  5. Re-apply mulch as necessary to maintain specified mulch thickness.

**END OF SECTION**

**SECTION 260501  
GENERAL ELECTRICAL PROVISIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
  - 1. The Contract Documents attached hereto represent portions of the Project, which have been identified by the Owner for the purpose of dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.
  - 2. The limits of each separate portion are determined by and are the responsibility of the Contractor who will provide direction, coordination, and resolution of disputes between separate Contractors, Subcontractors and trades in order to integrate the separate parts into the total construction of the Project.
  - 3. These extents, limits, and determinations are not the responsibility of the Architect/Engineer of Record.
- B. Drawings are schematic and diagrammatic. Use judgment and care to install all electrical work in a practical manner to function properly and fit the building construction and finishes. Electrical conductors, conduit, components, etc., not shown or specified which are required of any device or system to produce a complete and operative system are a requirement of this specification.
- C. Cooperate with other subcontractors/installers/suppliers in laying out work so that the Electrical Phase of the work will properly fit the site construction. Wall thickness, space requirements, etc., other than that shown on the Drawings, required to facilitate the electrical construction are to be directed to the Architect's and Owner's attention prior to commencing any work so that proper action may be taken to remedy this.
- D. Owner reserves the right to change the location of any outlet, device, or system improperly installed to fit equipment and/or finish and to change the exact location of any outlet, switch, device, etc., up to 10 feet (10') prior to rough-in with no additional cost.
- E. Provide the proper number of conductors and conduits or cables to produce an operative system as specified herein.
- F. No two ungrounded conductors will be connected to the same circuit breaker/fused switch in any panel. No splicing of branch circuit conductors in any panels, safety switches, or non-automatic circuit breakers in separate enclosures is allowed.
- G. All materials are new. Conform to the latest requirements of Underwriter's Laboratories, National Electrical Code, National, State or local agency having jurisdiction, and National Fire Protection (NFPA) Codes.
- H. Install, test, and connect all materials, devices, equipment, wiring systems, etc., in strict compliance with industry standards, manufacturer's recommendations, and as specified herein.
- I. Install all materials, equipment, devices, etc., in a neat and workmanlike manner.
- J. Protect from damage all apparatus and equipment furnished on this project. Equipment and materials shall be handled, stored, and protected in accordance with the manufacturer's recommendations. Store electrical conduit to provide protection from the weather and accidental damage. Store plastic conduit on even supports and in locations not subject to direct sun rays or excessive heat. Seal, store, and handle cables carefully to avoid damage to the outer covering of insulation and damage from moisture and weather. Repair, repaint, and/or replace any piece of equipment or material marred or damaged to the complete satisfaction of Owner.

- K. Any new piece of equipment, switch, device, etc., shown mounted on and/or adjacent to any equipment which if installed, would impair the proper operation of that existing equipment, will be removed and relocated by the Contractor with no cost to Owner as required in order that equipment will function properly.
- L. Preparation, handling, and installation shall be in accordance with the manufacturer's written instructions and data. Coordinate work and other suppliers in furnishing and placing of work. Review shop drawings of other trades to confirm measurements as necessary to properly perform work.

## **1.2 DISCREPANCIES**

- A. Should the Contractor find discrepancies or omissions in the Contract Documents, or be in doubt as to the intent, he shall immediately obtain clarification from the Architect/Owner before proceeding with work or purchasing.
- B. It is the Contractor's responsibility to review the Drawings and Specifications prior to submitting his bid, for compliance with the local regulations of the inspection agency, fire inspection agency and the local electric and telephone utilities.

## **1.3 RECORD DRAWINGS**

- A. Furnish to the Owner at job acceptance and completion one (1) set of drawings, showing an accurate location of the work actually installed related to the original Drawings. Include all approved and installed Change Orders, field condition changes, and other variations from the original Drawings and Specifications. Drawings shall be the record drawing sets that are updated and kept at the project site until the project has been completed.

## **1.4 POSTED OPERATING INSTRUCTIONS**

- A. Operating instructions approved by Owner shall be provided for each system and each principal piece of equipment for the use of operation and maintenance personnel. Operating instructions shall include such instructions as start-up, proper adjustment, operating, lubrication, shut-down, safety-precautions, procedure in the event of equipment failure, and any other necessary items of instruction as recommended by the manufacturer of the unit.

## **1.5 INSPECTIONS**

- A. The complete job shall, during actual construction, and for the warranty provision period, have the following performed.
  - 1. Upon written notice, furnish labor and tools to assist and be directed by Owner for a reasonable amount of time to make such tests and observations as are requested by the Architect and Owner pertaining to the safety and operation of any device or system installed.
  - 2. Inspection by any Federal, State, or local authority having jurisdiction of the project.

## **1.6 CODES, PERMITS, AND FEES**

- A. References to codes, standards, and specifications of technical societies, trade organizations, and governmental agencies shall mean latest editions.
- B. This electrical installation shall comply with:
  - 1. Local authorities.
  - 2. National Electrical Code (NEC).
  - 3. The regulations of the servicing Electrical Utility Company.
  - 4. Americans with Disabilities Act Guidelines (ADA).
  - 5. International Building Code (IBC).
  - 6. National Fire Protection Association (NFPA).
- C. The Contractor shall obtain and shall pay for all applications and permits required by the local authorities.

- D. Where, in any specific case, different sections of any of the aforementioned codes and regulations or Drawings and Specifications each specify different materials, methods of construction, or other requirements, the most restrictive shall govern. In the case of any conflict between a general provision and a special provision, the special provision shall govern.
- E. Contractors proposing to undertake work under this division shall review the Drawings and Specifications subsequent to the approval for permit by the local authorities, noting any and all comments, changes or additions to the work herein described, and immediately notify the Owner for proper coordination with his work and that of other divisions. The same shall apply for any similar circumstance arising during construction, prior to the completion of work.

#### **1.7 GUARANTEE**

- A. Guarantee work performed and all equipment installed under this contract shall be free from defects in workmanship and materials for a period of one year from date of final written acceptance by Owner, unless a longer guarantee is specified in the various sections..
- B. Defects shall be corrected arising during this period at the contractor's own expense, upon written notice of Owner.
- C. Guarantee all lamps as follows:
  - 1. All fluorescent and high intensity discharge (H.I.D.) lamp burn-outs occurring during the first one hundred-eighty (180) days after final acceptance. Replacements for these burn-outs shall be furnished and installed upon written notice from Owner.

#### **1.8 MANUFACTURER'S RECOMMENDATIONS**

- A. Manufacturer's recommendations for installation shall be followed for the installation of all equipment.

#### **1.9 DELIVERY, STORAGE, HANDLING AND SCHEDULING**

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Protect stored equipment and materials from damage.
- C. Do not install damaged equipment; remove from site and replace damaged equipment with new.

#### **1.10 REMOVAL OF SALVAGE MATERIAL AND DEBRIS**

- A. All trash, salvage material, etc. shall be removed from the site at all times during construction on a regular basis.

#### **1.11 TRENCHING AND BACKFILLING**

- A. Comply with OSHA Standards for all trenching.

#### **1.12 CUTTING, PATCHING, FINISHING, AND PAINTING**

- A. Paint all exposed conduit, piping, wireways, boxes, cabinets, etc., where exposed in any space other than listed herein.
- B. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair the structural value. Coordinate any cutting required.

### **1.13 CORROSION PROTECTION**

- A. All joints, connections, etc., exposed to climatic conditions to be completely watertight

### **1.14 SITE VISIT AND FAMILIARIZATION**

- A. Contractors proposing to undertake work shall:
  1. Visit the site of the work, and fully familiarize themselves of all conditions that affect the work or cost thereof.
  2. Examine the Drawings and specifications as related to the site conditions.
  3. Acquaint themselves with all utility companies from whom services shall be supplied; verify locations of utility service points, demarcations and interfaces and determine exact requirements.
- B. Consideration will not be granted for any alleged misunderstanding of the amount of work to be performed.

### **1.15 COORDINATION OF UTILITIES**

- A. It is the responsibility of the Contractor to coordinate all utilities location both overhead and underground and verify their locations with the various utilities prior to commencing any work. Special connection requirements shall be included.

### **1.16 SUBMITTALS**

- A. Provide submittal data bound in 8-1/2" x 11" folder with specification section referenced. Submittals shall consist of catalog datasheets containing physical dimension data and electrical characteristics complete enough to confirm operational compliance. Submittals are required for:
  1. Lighting fixtures and lamps.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

- A. Materials, equipment, and devices shall meet the requirements of UL where UL standards are established for those items, and the requirements of NFPA.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Equipment locations shall be as close as practical to locations shown on the Drawings and subject to such revisions as may be found necessary or desirable at the time the work is installed. Verify all dimensions by field measurements.
  1. Minor relocations may be made where required, provided that such work is coordinated with all other work and that there will be no impairment of system operation as a result.
  2. Major relocation shall not be made without prior approval.
- B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with the National Electrical Code.
- C. The National Electrical Contractors Association publication Standard of Installation shall be used as a reference as to the minimum quality of workmanship required.



- D. After work is complete clean light fixtures and electrical equipment to remove dust, dirt, grease, or other marks and leave work in clean condition.

### **3.2 COORDINATION**

- A. Interferences and clearances shall be coordinated and corrected with other Trades before proceeding with the work.
- B. The electrical work shall be coordinated with the work of the other trades. Obtain appropriate information of equipment prior to connection. Coordinate connection requirements, locations, etc.; some equipment may require multiple connections.
- C. Coordinate the cutting and patching with other Trades to accommodate the installation.
- D. Lay out the work on the premises and make proper provision for the work of other trades. The exact location of each item shall be determined by reference to the Drawings, by measurements on the site and in cooperation with other contractors. Accurately locate all openings required.
- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

### **3.3 EQUIPMENT IDENTIFICATION**

- A. Provide nameplates for the following as a minimum requirement:
  - 1. National Electrical Code Requirement: Other equipment and installations required to be identified or provided with warning or caution signs shall be so treated in a manner to comply with the National Electrical Code (NFPA 70) requirements and as contained herein.
- B. Provide complete warranty information for each item. Include date of beginning of warranty or bond, duration of warranty or bond, and names, addresses, telephone numbers and procedures for filing a claim to obtain warranty services.

### **3.4 PAINTING OF EQUIPMENT**

- A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA.

### **3.5 TESTING**

- A. Perform tests as specified to prove installation is in accordance with contract requirements. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications. Typed records of all the following tests shall be included in maintenance instructions. Tests, in addition to specific system test described elsewhere, shall include:
  - 1. Circuit Continuity: Test feeder and branch circuits for continuity. Test neutrals for improper grounds.
  - 2. Equipment Operations: Test motors for correct operation and rotation.
  - 3. Product Failure: Products which fail during the tests or are ruled unsatisfactory by the Architect shall be replaced, repaired or corrected as prescribed by the Architect at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

**END OF SECTION**

**SECTION 260519  
WIRES AND CABLES**

**PART 1 GENERAL**

**1.1 SUMMARY:**

- A. Section Includes:
  - 1. Wire and cable.
  - 2. Wiring connectors and connections.
- B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

**1.2 REFERENCES**

- A. National Fire Protection Association (NFPA):
  - 1. ANSI/NFPA 70 - National Electrical Code.
- B. Regulatory requirements
  - 1. Conform to requirements of ANSI/NFPA 70.

**1.3 PROJECT CONDITIONS**

- A. Routing shown on Drawings is diagrammatic only. Determine exact routing and lengths required.
- B. Determine required separation between cable and other work.
- C. Determine cable routing to avoid interference with other work.

**PART 2 PRODUCTS**

**2.1 WIRE AND CABLE**

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 Volts.
- D. Insulation: ANSI/NFPA 70, Type THHN/THWN.
- E. Insulation Temperature Rating 90 degrees C.
- F. UL Listed. Minimum size #12 for power circuits and #14 for control circuits unless noted otherwise.

**PART 3 EXECUTION**

**3.1 GROUPING OF CONDUCTORS**

- A. Maximum three hots, three neutral, and three ground may be contained in one raceway without derating. This does not imply a neutral is required for each hot.
- B. Mixing of conductors from different voltage classes is prohibited.

**3.2 INSTALLATION**

- A. Swab raceway before installing wire.
- B. Install products in accordance with manufacturer's instructions.

- C. Use stranded conductors for control circuits and final connections to all vibration equipment.
- D. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- E. Pull all conductors into raceway at same time.
- F. Protect cable from damage.
- G. Clean conductor surfaces before installing lugs and connectors.
- H. Make splices, taps, and terminations to carry full ampacity of conductors.
- I. Use only compression connectors for copper conductor splices and taps, #6 AWG and larger.
- J. Use solderless pressure compression connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller 90 degrees C rated.
- K. Inspect wire and cable for physical damage and proper connection.
- L. Verify continuity of each branch circuit conductor.
- M. Install a properly sized grounding conductor in all raceways containing power circuits.
- N. Comply with the following color code or as required by local authority:

208Y/120 Volt System

Phase A - Black  
Phase B - Red  
Neutral - White.  
Equipment Ground - Green.

480Y/277 Volt System

Phase A - Brown  
Phase B - Orange.  
Phase C - Yellow  
Neutral - Grey.  
Equipment Ground - Green/with Yellow stripe.

- O. Electrical Tests:
  - 1. Perform insulation resistance test on each feeder and branch circuit conductor with respect to ground and adjacent conductors. Applied potential: 1000 volts dc for 1 minute.
  - 2. Perform continuity test to insure proper cable connection.
  - 3. Minimum insulation resistance values: two megohms.

**END OF SECTION**

**SECTION 260533  
RACEWAY SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Conduits, ducts, boxes, etc.
- B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

**1.2 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
  - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
  - 3. ANSI C80.5 - Rigid Aluminum Conduit.
- B. National Electrical Contractors Association (NECA):
  - 1. NECA "Standard of Installation."
- C. National Electrical Manufacturers Association (NEMA):
  - 1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 2. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
  - 3. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
  - 4. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- D. National Fire Protection Association (NFPA):
  - 1. ANSI/NFPA 70 - National Electrical Code.
- E. Design Requirements
  - 1. ANSI/NFPA 70 (N.E.C.), unless noted otherwise on the Drawings.
  - 2. Furnish products listed and classified by Underwriters Laboratories, Inc.

**1.3 PROJECT CONDITIONS**

Routing shown on drawings is diagrammatic only, determine exact routing and lengths required.

**PART 2 PRODUCTS**

**2.1 CONDUIT REQUIREMENTS**

- A. Minimum size conduit as 3/4"
- B. Install in accordance with the following schedule.
  - 1. In all concrete: Galvanized rigid steel (GRC) or Schedule 40 PVC as noted. Coat metallic conduit with polyvinyl polyethylene or asphalt application.
  - 2. Conduit in earth (no encasement): Schedule 40 PVC.
  - 3. MC cable may be used only where all of the following conditions are met:
    - a. final connections to fixtures and equipment
    - b. restricted to 5 feet maximum length
    - c. areas concealed from public view

## **2.2 FITTINGS**

- A. Use insulated throat compression connector fittings listed for the raceway on which they are used.

## **2.3 CONDUIT STRAPS AND HANGERS**

- A. Not required.

## **2.4 EXPANSION AND SEAL-OFF FITTINGS**

- A. Expansion fittings in conduits where shown on the Drawings or where required to pass through expansion joints embedded in concrete.

## **2.5 CONDUIT**

- A. Rigid Galvanized Steel Conduit (GRC): ANSI C801. UL6.
- B. Intermediate Metal Conduit (IMC): UL1242.
- C. Flexible Metal Conduit: Interlocked steel and aluminum construction.
- D. Nonmetallic Conduit NEMA TC 2: Schedule 40 PVC.
- E. Liquidtight Flexible Metal Conduit: Interlocked steel and aluminum construction with PVC jacket.
- F. Electrical Metallic Tubing (EMT): ANSI C80.3.

## **2.6 OUTLET BOXES**

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported.
  - 2. Receptacle and Switch Boxes – sized for the appropriate number of conductors.
- B. Cast Boxes: NEMA FB 1, Type FD. Provide gasketed cover by box manufacturer. Provide threaded hubs.

## **2.7 PULL AND JUNCTION BOXES**

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install all raceway in accordance with manufacturer's instructions.
- B. Size all raceway in accordance with NEC.
- C. Group related conduits; support using conduit rack. Construct rack using approved steel channel.
- D. Do not support conduit with wire or perforated pipe straps in any type structure. Remove wire used for temporary supports. Steel tie wire may be used to anchor conduit down to reinforcing rods in concrete encasement only.
- E. Cut conduit square; de-burr cut ends and ream. Bring conduit to shoulder of fittings; fasten securely
- F. Use conduit hubs or locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- G. Use conduit bodies to make sharp changes in direction. Comply with NFPA 70 on all bends. Make conduit bends only with bending tools.

- H. Avoid moisture traps; provide junction box at low points in conduit system.
- I. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- J. Provide suitable nylon pull string in each conduit except sleeves and nipples.
- K. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- L. Ground and bond conduit.
- M. Install knockout closures in unused box openings.
- N. Support boxes independently of conduit.
- O. Cap all upturned conduits during construction rough-in to prevent moisture or debris from entering. Swab to remove any and all moisture.
- P. Support conduits as required by NFPA 70 (N.E.C.)

**END OF SECTION**