



State of Utah

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Lieutenant Governor

Department of Administrative Services

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Executive Director

Division of Facilities Construction and Management

DAVID G. BUXTON  
Director

## ADDENDUM NO. 1

Date: July 21, 2009

To: Contractors

From: Wayne Smith – Project Manager

Reference: JLTC Landscape – Phase II – Camp Williams  
Utah National Guard – Riverton, Utah  
DFCM Project No. 07011480

Subject: **Addendum No. 1**

Pages	Addendum Cover Sheet	1 page
	<u>Architect's Addendum No. 1</u>	<u>127 pages</u>
	Total	128 pages

**Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to Disqualification.**

While we contend that SB220 should only be potentially applicable to a contract issued after the effective date of said bill, this is to clarify that for purposes of this contract, regardless of the execution or effective dates of this contract, the status of Utah Law and remedies available to the State of Utah and DFCM, as it relates to any matter referred to or affected by said SB220, shall be the Utah law in effect at the time of the issuance of this Addendum.

1.1 **SCHEDULE CHANGES:** No Project Schedule changes.

1.2 **GENERAL ITEMS:** See attached Architect's Addendum No. 1.

## ADDENDUM NO. 1



**Stantec**

BID DOCUMENTS FOR  
JLTC LANDSCAPE – PHASE II – CAMP WILLIAMS UTAH  
NATIONAL GUARD

ISSUED BY:

July 20, 2009  
FILE: 07011480

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This Addendum is to be issued to bidders and forms a part of the Contract Documents and modifies the original Bidding Documents.

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### 1. Clarifications

- 1.1. Camp Williams will supply the boulders. The contractor is responsible to haul them and place them.
- 1.2. Contractor's are to field verify the length of pipe needed to bring the secondary irrigation water to the project area.
- 1.3. Sidewalk has been added to the front of building's 1 and 2. See Exhibit 1. Adjust landscape and irrigation as needed. The sidewalk in front of building 2 is not to exceed 5% slope, excluding the steps. Contractor to place steps as needed to maintain the 5% maximum slope. Construct curb cuts per APWA specifications. Steps to have a maximum 7" tread height and a minimum 12" tread depth. Place handrails and/or guardrails as required per latest building code.
- 1.4. The concrete pad between building's 3 and 4 has been moved between building's 2 and 3. See Exhibit 1. Adjust irrigation and landscaping as needed.
- 1.5. 2" Cobblestone is to be placed in the alcoves of each building. See Exhibit 1. Adjust landscape and irrigation as needed.

### 2. Specifications

- 2.1.1. The specifications were not included in the bidding documents posted on July 15, 2009 and are included in this addendum.

### 3. Additive Alternates

- 3.1. Additive Alternate 1: All Parking Lot work including lighting, landscaping and irrigation.

### 4. Attachments

- 4.1. Specifications
- 4.2. Exhibit 1

### Distribution:

Each Bidder  
Project File  
Camp Williams  
DFCM

# *Project Manual*

*Construction Specifications*

## *Phase 2*

*Electrical & Landscape*

*Development*

*Camp Williams JLTC Buildings 1-4*

*July 2, 2009*

## **DIVISION 1 GENERAL REQUIREMENTS**

<u>SECTION</u>	<u>TITLE</u>
01400	QUALITY CONTROL

## **DIVISION 2 SITE WORK**

<u>SECTION</u>	<u>TITLE</u>
02200	EARTHWORK
02222	EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES
02230	SITE CLEARING
02710	WATER DISTRIBUTION
02810	IRRIGATION
02913	SOD
02950	PLANTING
02952	NATIVE SEEDING

## **DIVISION 16 ELECTRICAL**

<u>SECTION</u>	<u>TITLE</u>
16001	ELECTRICAL GENERAL PROVISIONS
16110	CONDUIT RACEWAYS
16120	WIRES AND CABLES
16135	ELECTRICAL BOXES AND FITTINGS
16142	ELECTRICAL CONNECTIONS FOR EQUIPMENT
16190	SUPPORTING DEVICES
16195	ELECTRICAL IDENTIFICATION
16450	GROUNDING
16475	OVERCURRENT PROTECTIVE DEVICES
16551	ROADWAY AND PARKING AREA LIGHTING

**SECTION 01400**  
**QUALITY CONTROL**

**PART 1 - GENERAL**

1.01 SITE INVESTIGATION AND CONTROL

- A. The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the work due to his failure to comply with this requirement.
- B. The Contractor shall inspect related and appurtenant work and shall report in writing to the Engineer any conditions which will prevent proper completion of the work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at his sole cost and expense.

1.02 INSPECTION OF THE WORK

- A. The work shall be conducted under the general observation of the Engineer and shall be subject to inspection by representatives of the Engineer acting on behalf of the Owner to insure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop or field inspection, as required. The Engineer shall be permitted access to all parts of the work, including plants where materials or equipment are manufactured or fabricated.
- B. The presence of the Engineer or any inspector(s), however, shall not relieve the Contractor of the responsibility for the proper execution of the work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the Engineer or any inspector(s).

1.03 COSTS

All costs for quality control shall be considered incidental to the Work and included in line item costs on the Bid Form.

**PART 2 - PRODUCTS**

- 2.01 All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the work until they have been inspected and accepted by the Engineer or his authorized representative. No work shall be backfilled, buried, cast in concrete, hidden or otherwise covered until it has been inspected by the Engineer or his authorized representative. Any work so covered in the absence of inspection shall be subject to uncovering. Where uninspected work cannot be uncovered,

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such as in concrete cast over reinforcing steel, all such work shall be subject to demolition, removal, and reconstruction under proper inspection, and no addition payment will be allowed therefore.

**PART 3 - EXECUTION**

3.01 TIME OF INSPECTION AND TESTS

- A. Samples and test specimens required under these Specifications shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analysis before said articles or materials are to be used. The Contractor shall furnish and prepare all required test specimens at his own expense.
- B. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any work under the Contract, he shall notify the Engineer not less than 24 hours in advance to request inspection before beginning any such work of covering. Failure of the Contractor to notify the Engineer at least 24 hours in advance of any such inspections shall be reasonable cause for the Engineer to order a sufficient delay in the Contractor's schedule to allow time for such inspections and any remedial or corrective work required, and all costs of such delays, including its effect upon other portions of the work, shall be borne by the Contractor.

3.02 SAMPLING AND TESTING

- A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the Owner reserves the right to use any generally-accepted system of inspection which, in the opinion of the Engineer will insure the Owner that the quality of the workmanship is in full accord with the Specifications.
- B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Specifications.
- C. Notwithstanding the existence of such waiver, the Engineer shall reserve the right to make independent investigations and tests as specified in the following subparagraph and, upon failure of any portion of the work to meet any of the qualitative requirements of the Specifications, shall be reasonable cause for the Engineer to require the removal or correction and reconstruction of any such work.
- D. In addition to any other inspection or quality assurance provisions that may be

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specified, the Engineer shall have the right to independently select, test, and analyze, at the expense of the Owner, additional test specimens of any or all of the materials to be used.

- E. Results of such tests and analysis shall be considered along with the tests or analysis made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed; provided, that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the Engineer, which fails to meet the requirements of the Specifications, all costs of such independent inspection and investigation, and all costs of removal, correction, and reconstruction or repair of any such work shall be borne by the Contractor.

3.03 RIGHT OF REJECTION

- A. The Engineer, acting for the Owner shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of these Specifications, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the work at the site. If the Engineer or inspector, through an oversight or otherwise, has accepted materials or work which is defective or which is contrary to the Specifications, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by the Engineer for the Owner.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the work after notification of rejection.
- C. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

3.04 GUARANTEE

For a period of one (1) year, commencing on the date of final acceptance or the date that the substantial completion letter is sent, the Contractor shall upon receipt of notice in writing from the Owner, promptly make all repairs arising out of the faulty materials, workmanship, or equipment. Prior acceptance of the work in no way shall waive the Contractor's responsibility to repair any portion of the work performed under this contract. The Owner is hereby authorized to make such repairs, if ten days after giving such notice to the Contractor, the Contractor has failed to make or undertake the repairs. In cases of emergency, where in the Owner's opinion, delay could cause serious loss or damage, repairs may be made without notice being sent to the Contractor and the expenses in connection therewith shall be charged to the Contractor.

**END OF SECTION 01400**

**SECTION 02200**

**EARTHWORK**

**PART 1 GENERAL**

**1.01 SUMMARY**

A. Section Includes:

1. Topsoil stockpiling, trenching or excavation and backfilling for utility systems and related appurtenances;
2. Excavation, backfilling and compacting for structures, pavements and sidewalks including dewatering, erosion control, and other items of earthwork as shown on Drawings and specified herein.

B. Related Documents:

1. 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.

C. Related Sections:

1. Section 02222 - Excavating, Backfilling and Compacting for Utilities.
2. Section 02230 – Site Clearing.

**1.02 SUBMITTALS**

A. Test Reports:

1. Field density (compaction) test reports of each test made.
2. Optimum moisture-maximum density curves for each type of soil encountered.

B. Fill Samples and Tests:

1. Provide for each type fill material to be used on project, with testing results indicating compliance with requirements specified, for approval prior to start of work.
2. The Owner shall authorize each type of fill to be used on the project as structural fill. (See articles 2.01 through 2.04 of this section).

**1.03 QUALITY ASSURANCE**

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- A. Regulatory Requirements: Comply with applicable requirements of federal, state and local laws, regulations and codes having jurisdiction at project site
- B. Reference Standards: Applicable requirements of standards and specifications referenced herein apply to the work of this Section.
- C. Field Quality Control: Testing and Inspection: Contractor will obtain and pay for services of an independent commercial testing laboratory for performing field quality control testing of soils during construction; costs of retesting because of noncompliance with requirements specified, including recompaction of deficient areas, are at Contractor's expense.

1.04 PROJECT CONDITIONS

- A. Coordination: Coordinate all work with City and Utility Company Personnel.
- B. Cooperation: Coordinate this work with the work of other Sections to avoid any delay in progress of building or any interference with progress of other work. Where required for proper construction operations, perform portions of work included in this Section separate from general building excavation as directed.
- C. Payment for Soils Work:
  - 1. The Contractor shall be responsible for the cost of preparing the site for the proposed construction including excavation, stockpiling, providing suitable fill material for satisfactory subgrade and final site preparation, removal and replacement of unsuitable material exposed on surface or encountered within existing soil as it is excavated to six inches below spread footings or slabs on grade as well as to the depth and extent specified or shown on the Drawings for installation of all site improvements including foundations, utilities, paving, sidewalks, and on-site structures. The cost for this shall be included in the Contractor's base bid, and shall be at no additional cost to Owner.
  - 2. The Owner shall have final authority and make the final decision during construction on the depth and extent to which unsatisfactory materials need to be removed and replaced. Any additional excavation, soil remediation or replacement must be authorized by the Owner prior to starting that work.
- D. Excavation Classification: All excavation work is unclassified and includes removal and disposal of earth fills, rock, rubble, trash and other materials encountered in excavation and grading operations. The Contractor's basic bid includes all costs for providing a site acceptable for the proposed construction. No additional payment shall be made for removal and replacement of unacceptable materials encountered during site preparation. In the event rock is encountered, rock removal shall not be performed. The Owner shall be the final authority and shall make the final decision during Construction to the depth and extent to which unsatisfactory materials must be

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removed and replaced.

E. Existing utilities:

1. Locations indicated are approximate
2. Contact local utility location service (Blue Stakes) 48 hours prior to excavation and verify exact locations of all existing utilities.
3. Perform necessary exploratory tests for verification if necessary. The Owner, the Architect and the Engineer will assume no responsibility for hazardous conditions, losses and accidents arising out of failure to perform by the Contractor or other Parties or both.
4. Should incorrectly charted or uncharted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility services in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility owner.

F. Disposition of utilities:

1. Observe rules and regulations governing respective utilities during execution of work of this Section.
2. Adequately protect all active utilities from damage:
3. Remove or relocate active utilities only as shown or as specified.

G. Benchmarks, Monuments and Other Reference Points: Protect from damage and displacement; if disturbed or destroyed, replace at Contractor's expense.

H. Keep dirt, dust, noise and other objectionable nuisances to a minimum. The Contractor is responsible to comply with all applicable local ordinances.

I. Protection:

1. Barricades:

- a. Furnish and maintain barricades, signs and markings for excavated areas in accordance with requirements of all local codes and as herein specified.
  - b. Paint and maintain barricades in good condition. Mount flashing yellow lights and maintain same.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

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3. Protect excavation bottom against freezing when atmospheric temperature is less than 35 degrees F.

**PART 2 PRODUCTS**

2.01 FILL AND BACKFILL MATERIALS - GENERAL

- A. A cut and fill balance has not been made. Contractor is responsible for establishing quantity of additional fill required or excess that must be hauled away. No additional compensation will be made for importation of additional material or for disposal of surplus material off site, as specified herein.

2.02 STRUCTURAL FILL

- A. Acceptable Materials: One or combination of following, as required, as approved by Owner and recommended by Soils Engineer:
  1. On-Site Excavated Material, excluding debris, other deleterious materials and unacceptable soils as defined by Section 2.02 B..
  2. Imported Materials
    - a. ASTM D2487 Soil Classification Groups GW, GM, GP-GM, GW-GM, SM, SW. Maximum percentage passing #200 Sieve: 15%
    - b. ASTM D2487 Soil Classification Groups SP and GP may not be used.
- B. Unacceptable Materials: ASTM D2487 Soil Classification Groups SC, CL, CH, PT, OH, OL, ML, MH, generally described as and including following:
  1. Peat, mulch and/or other highly organic swamp soils.
  2. Organic and inorganic clays of low to high plasticity.
  3. Silts and Elastic silts.

**PART 3 EXECUTION**

3.01 EXAMINATION

- A. Examine areas in which work is to be performed. Report in writing to Owner all prevailing conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting work constitutes acceptance of the existing conditions and the Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and

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defective work encountered.

3.02 PREPARATION

- A. The civil drawings show the original topography and proposed limits of construction.
- B. In case of conflict between final grade elevations (finish grade) shown by spot elevations and by contours, contact the Engineer for clarification before proceeding.
- C. Conform to dimensions and elevations indicated. Do not exceed plus or minus five-tenths of one-foot variation from design grading elevations shown unless approved by the Engineer in writing.
- D. Dewatering:
  - 1. Prevent ground and subsurface water from flowing into excavations, from flooding project site and surrounding properties, and from collecting and ponding; provide and maintain all temporary drainage and dewatering systems required.
  - 2. Install pumps, sumps and suction and discharge lines, as required.
  - 3. Install temporary deviations from grades indicated to channel water away from excavations.
  - 4. Leave no sumps or pockets at completion of each day's grading operations.
  - 5. If water is encountered during footing and foundation excavation, install pumps of capacity to remove water while excavations are being made and continue pumping for 24 hours following placing of concrete footings and erection of foundation walls to grade. Maintain dewatering operations until construction of permanent drainage is completed.
- E. Shoring and Bracing:
  - 1. Install as required to protect slopes and earth banks from cave-ins, and to protect adjacent surfaces and structures from settlement. Remove before backfilling is completed, but not until after permanent supports are in place.
  - 2. When work is interrupted by rains, do not resume operations until moisture content and field density tests of upper 6" of in-place materials have been made by the Soils Engineer and approved by Owner.
  - 3. Shoring, bracing or underpinning required for the project (if any) shall be designed by a professional engineer registered in the State of Utah.
- F. Do not place fill or backfill material in water, on material containing frost, or during

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unfavorable weather conditions. When inclement weather is expected, grade and seal surface of fill as required to limit percolation of surface water.

- G. Establish and identify required lines, levels, contours and datum.
- H. Topsoil Stripping and Conservation: Following requirements may be waived by Soils Engineer in areas that do not contain satisfactory topsoil:
  - 1. Remove topsoil of horticultural value from areas to be covered by new building construction and from areas to be paved, excavated, or regraded. Remove without contamination with subsoil. Strip to 6" minimum depth. Keep free of roots, stones and other undesirable materials. Do not strip topsoil when wet.
  - 2. Stockpile in locations convenient to areas shown to receive topsoil later or where directed by Soils Engineer. Do not stockpile to depth exceeding 8 feet. Do not drive heavy equipment over stockpiled material or spread topsoil.
- I. Proof-rolling:
  - 1. Proof-roll over entire areas receiving fill material, after topsoil and existing fill is removed, in presence of the owner's representative.
- J. Following topsoil stripping, existing fill removal and proof-rolling operations, but before placing fill and backfill, clean ground surfaces free of all trash; debris; loose, frozen, wet or soft soil; and other undesirable surface materials before proceeding with work.
- K. Soil Remediation:
  - 1. Undercut and remove soft or unstable soils that fail to compact and replace with acceptable fill material compacted to density specified in Section 3.04. Place soil in lifts of 8" loose depths and compact each lift to density specified when using heavy compaction equipment, and lifts not more than 4" loose depth for material compacted by hand operated tampers.
  - 2. Before compaction, moisten or aerate each layer as needed to provide optimum moisture content. Compact each layer to required percentage of density for each area classification. Do not place backfill or fill materials on surfaces that are muddy, frozen, or contain frost or ice.
  - 3. Place backfill and fill material evenly adjacent to structures, piping or conduit to required elevations. Carry material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

3.03 GRADING

- A. Earthwork contractor shall bring finish grades to the finished grades shown on the Drawings in all areas. In landscaped areas, the landscape contractor shall complete

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the grading. Earthwork contractor shall remove all excess topsoil from site and stockpile only the amount necessary to complete finish work.

- B. Grade to required profiles, contours, elevations and subgrade levels shown on Drawings, with allowances made for depths required for placement of topsoil and construction of paving, walks, equipment slabs or pads and floor slabs.
  - 1. Lawn and landscaped areas: Finish areas to receive topsoil to within not more than 0.1 foot above or below required subgrade elevations.
  - 2. Walks: Shape surfaces of areas under walks to line, grade, and cross section, with finish surface within 0.1 foot of required subgrade elevation.
  - 3. Pavements: Shape surface under pavement to line, grade and cross section, with finish surface within ½ inch of required subgrade elevation.
  - 4. Building slabs: Under building slabs grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within ½ inch tolerance when tested with a 10 foot straight edge.
- C. Control grading around buildings and on site; slope ground away from buildings to prevent water from running into excavated areas or damaging other structures so that entire project is well drained and free from water pockets.
- D. Provide uniform levels and slopes between elevations shown on Drawings, and between elevations shown and existing finished grades shown to be maintained. Round abrupt changes in slopes.

3.04 STRUCTURAL FILL

- A. General:
  - 1. Soils Engineer based upon test results, is sole judge as to when specified compaction densities have been obtained. When retesting is needed to verify that unacceptable site preparation has been remedied, the cost for retesting shall be paid by the Contractor.
  - 2. Contractor is responsible for correcting at his expense, including costs of testing, all areas with insufficient compaction.
  - 3. Place acceptable material in horizontal lifts not exceeding 8" in loose depth, with each lift extending for entire length and width of each area being filled. Level material which is frozen or contains frost.
  - 4. Reduce or increase moisture content of fill by drying or uniform sprinkling with water, as required to achieve moisture content within 2% of optimum as required for specified degree of compaction.

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5. Disk each layer of fill to break down oversize clods, to thoroughly mix nonuniform materials, and to secure uniform moisture content, as required to insure uniform density and proper compaction.
  6. Maintain positive surface slope to allow runoff and to prevent ponding of surface water. If surface water ponds, dewater as required. Remove all saturated or disturbed soil before placing additional fill material.
  7. Number of compaction equipment passes required is dependent upon degree of compaction specified. Overlap rolling passes as required to completely cover area of fill.
  8. After cuts are made and existing fill is removed,, scarify entire area to 8" depth and compact to following minimum density for areas listed:
    - a. Areas Receiving Structural Fill: 95% Modified Proctor Density (ASTM D-1557) within 2% of optimum moisture content.
    - b. Under Paving and Walk Areas: 95% Modified Proctor Density within 2% of optimum moisture content.
    - c. Under Lawn and Unpaved Areas: 90% Modified Proctor Density (ASTM D-1557).
- B. Structural Fill:
1. Material: Acceptable materials complying with the requirements of Articles 2.01 and 2.02.
  2. Location: Place as subgrade under building, pools and pool decks, to a point 5 feet outside building walls and pool decks. Place as subgrade under pavements and walkways to a point 2 feet beyond edge.
  3. Construct to grades and for minimum depths indicated. Undercut existing grade as required.
  4. Compact to 95% of Modified Proctor Density (ASTM D-1557), at moisture content within 2% of optimum; maintain specified moisture content until placement of floor and deck slabs, and obtain Owner's approval of method used for maintaining moisture control.
- C. Nonstructural Fill:
1. Materials: Acceptable Materials complying with requirements of Articles 2.01 and 2.02.

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2. Location: Use for all other fills, unless otherwise specified or directed by Owner.
3. Construction to grades and for minimum depths indicated. Undercut existing grade as required.
4. Compact to following densities for areas listed:
  - a. Subgrade Below Paving, Walks, and Slabs on Grade: 95% of Modified Proctor Density at moisture content within 2% of optimum.
  - b. Below Grassed and Planted Areas: 90% of Standard Proctor Density.

3.05 FOUNDATION AND FOOTING EXCAVATION

- A. If grade beam foundation, excavate bottom of foundations to exact grade called for on Drawings. Do not disturb bottom of excavation. Fill over-excavated areas with concrete.
- B. Excavate 4" lower than scheduled grade beam depths for void box placement.
- C. Excavate beyond outside of walls to allow for inspection, placing and removal of forms and for installing of waterproofing and drain tile, except where concrete is authorized to be deposited directly against excavated surfaces. Leave excavation open until work has been inspected and approved.
- D. If pile foundations, stop excavations from 6" to 12" above bottom of footing before piles are placed. After piles have been driven or drilled, remove loose or displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3.06 FOUNDATION BACKFILL

- A. Material: Acceptable Structural Fill material complying with requirements of Articles 2.01 and 2.02.
- B. Remove surface debris and debris in excavation before placing backfill.
- C. Do not use material which is frozen or contains frost.
- D. Allow footing and foundation walls to attain full design strength before placing backfill.
- E. Exercise care during placing and compacting operations. Place to prevent wedging action, eccentric loading, and displacement of walls or structure.
  1. Use hand operated compaction equipment within 4 feet of walls.
  2. Where fill is placed along both sides of foundation walls, place and compact simultaneously on both sides of walls.

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3. Repair, or remove and replace, all damage to foundation walls and structure occurring during placement and compaction operations at no additional cost to Owner.
- G. Place material in horizontal lifts not exceeding 8" loose depth before compacting. Level each lift before compacting. When using hand compaction equipment, do not exceed 4" loose depth per horizontal lift.
- H. Compact all backfill to 98% of Modified Proctor Density within 2% of optimum moisture content.

3.07 TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS

A. Trench Excavation:

1. Provide open cut excavation, except short sections may be tunneled if approved by consultant and demonstrated by Contractor that pipe, cable or duct can be properly installed, backfilled and compacted. Heavy construction equipment, building materials, excavated soil and vehicular traffic should not be allowed within 1/3 of the slope height from the top of any excavation.
2. Excavate to necessary width, depth and alignment for proper material installation. Cut trench banks as nearly vertical as practicable, but to safety standards of governing authorities. Stockpile material suitable for backfilling a sufficient distance from banks to avoid overloading and cave-ins.
3. Accurately grade trench bottoms to provide uniform bearing and support for each pipe section on undisturbed soil along full pipe length, except for areas where necessary to excavate for bell holes and for sealing pipe joints. Dig holes and depressions for joints after trench bottom has been graded, so pipe rests on prepared bottom for full length. Remove all stones to avoid point bearing. When excavating in rock, provide at least 4 inches of soil cushion on all sides of pipe and accessories. The use of 3/4" (max) gravel for pipe haunching and embedment shall be acceptable when it meets the approval of the pipe manufacturer and Owner's Construction Representative.
4. Remove wet or otherwise unstable or unacceptable material encountered beyond depths indicated and replace with sand, gravel or concrete.

- B. Excavation for Appurtenances: Excavate for manholes and similar structures, to leave 12" minimum clearance between outer surfaces and embankment or timber used to hold and protect banks. Fill over-excavation with sand, gravel or concrete.

C. Backfilling:

1. Do not backfill until utilities systems have been inspected and accepted by the Owner.

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2. Backfill Materials: Acceptable Structural Fill materials at all other locations, complying with requirements of Articles 2.01 and 2.02.
3. Deposit material in lifts of 8" loose depth before compacting each lift to 95% of Modified Proctor Density within 2% of optimum moisture content under paving, walks, building slabs, and other slabs on grade, and compacting to 90% of Modified Proctor Density under lawns and planting areas. When using hand compaction equipment, place material in lifts not to exceed 4" loose depth.
4. Backfill trenches to top of ground level.
5. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
6. Restore ground surface, pavements, base courses, and compacted subgrade disturbed by utilities systems trenching and backfilling work to their original condition, construction and finishes.

3.08 FIELD QUALITY CONTROL

- A. Testing and Inspection Services: Contractor will retain the services of a testing firm to perform observations, inspections and testing during execution of site work and any other tests deemed necessary to determine compliance with specifications.
- B. Contractor shall coordinate with testing firm's Inspectors and Technicians to facilitate the execution of their duties.
- C. Upon completion of excavation, testing firm shall inspect and test the work and determine the suitability of the soil and preparation of subsequent site work.
- D. Testing firm will submit to Owner reports of all observations, inspections and tests.

**END OF SECTION 02200**

**SECTION 02222**

**EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Obtain excavation permits from state and local authorities.
- B. Excavate for utility systems and process piping systems, including manholes, catch basins, valves, and other appurtenances to the points of connection with the building utility or structure piping five (5) feet outside of the building or structure.
- C. Locate and protect existing utilities, structures, landscaping, and other existing features.
- D. Dewater excavations as required.
- E. Support excavations as required.
- F. Place and compact bedding, pipe zone, and backfill materials over pipes and appurtenances to rough grade elevation.
- G. Stockpile and dispose of material

**1.02 QUALITY ASSURANCE**

- A. Provide soil testing during excavation and placement of fill and backfill materials in accordance with Section 01400.
- B. Perform soil testing during excavation and placement of fill, bedding, initial backfill, and backfill materials to show compliance with the requirements of the Contract Documents.

**1.03 REFERENCES**

- A. ASTM D422 Particle Size Analysis of Soils.
- B. ASTM D424 Calculating the Plasticity Index.
- C. ASTM D698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in (304.8 mm) Drop.
- D. ASTM D1556 Density of Soil In Place by the Sand-Cone Method.

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- E. ASTM D1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10-pound rammer and 18-inch drop. (Modified Proctor).
- F. ASTM D1663 Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
- G. ASTM D2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- H. ASTM D2487 Classification of Soils for Engineering Purposes.
- I. ASTM D2901 Test Method for Cement Content of Freshly-Mixed Soil-Cement.
- J. ASTM D2922 Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).
- K. ASTM D3017 Test Methods for Moisture Content.
- L. ASTM D4253 Test Methods for Maximum Index Density of Soils, using a Vibratory Table.
- M. ASTM D4254 Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
- N. Federal Occupational Safety and Health Administration, *Federal Register*, Volume 37, No. 243, Sub-part P, Section 1926-652.

1.05 DEFINITIONS

- A. Suitable Material: Excavated material from the site or imported material from off-site meeting the requirements of structural fill or non-structural fill material.
- B. Unsuitable Material: Excavated material from the site that does not meet the requirements of structural fill or non-structural fill. This material shall be removed from the site.
- C. Structural Fill: Fill placed on prepared subgrade in areas which will ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.
- D. Non-structural Fill: Fill placed on prepared subgrade outside of areas which will ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.
- E. Borrow Material: Material imported from off-site but made available at an Owner owned/designated site. It is anticipated that borrow material will meet the requirements for structural fill material. If the quantity of acceptable borrow material is not sufficient to complete the Work, the Contractor shall notify the

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Engineer in writing. The notification shall include an estimated quantity of material required to complete the Work and the Contractor's Geotechnical Engineer's explanation for non-complying material.

1.06 SUBMITTALS

Submit the following to the Engineer:

- A. Certified sieve analysis of the following materials and samples of the materials when requested by the Engineer:
  - 1. bedding and initial backfill
  - 2. imported trench fill
  - 3. foundation material (if required)
- B. One optimum moisture-maximum density curve for each type of soil encountered or incorporated into the Work.
- C. Compaction testing results.
- D. For record purposes only and not for review or approval, submit shop drawings and data showing the intended plan for dewatering operations. Include locations and capacities of dewatering wells, well points, pumps, sumps, collection, and discharge lines, standby units, water disposal methods, monitoring and settlement measuring equipment, and data collection and dissemination. Submit, together with a copy of the approved UPDES permit, as applicable, not less than 15 days prior to start of dewatering operations.

**PART 2 - PRODUCTS**

2.01 FOUNDATION MATERIAL

Foundation material shall be granular well-graded material with a maximum aggregate size of 2 inches and not more than 5 percent passing the 200 sieve.

2.02 BEDDING, PIPE ZONE, AND INITIAL BACKFILL MATERIAL

- A. Sanitary Sewer and Storm Drain: Bedding, pipe zone, and initial backfill material shall be clean free-draining well-graded crushed gravel with a maximum aggregate size of 1 inch. Crushed rock meeting the gradation requirements shown below shall be submitted for approval by the Engineer.

1-Inch Crushed Gravel

Sieve Size

Percent Passing by Weight

1"

100

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3/4"	90-100
1/2"	20-55
#4	0-1
#8	0-5

- B. Water, Gas, Electric, Telephone, or Buried Cables: Bedding, pipe zone, and initial backfill material shall be clean granular natural sand material, free from organic matter, conforming to the gradation requirements shown below:

3/8"	100
#4	35-100
#30	20-100

2.03 FINAL BACKFILL UNDER STRUCTURES, PAVEMENT, AND WALKS

- A. Fill and final backfill for utilities under and immediately adjacent to structures, pavement prisms, and walks shall be structural fill material consisting of clean, well-graded, non-expansive granular sand and gravel material imported from off-site with a maximum size of 3 inches, no greater than 35 percent passing the No. 200 sieve, and a liquid limit of no greater than 30 percent. The material shall be capable of attaining the required densities when compacted.
- B. Native material will be acceptable for final backfill under walks, pavement, or structures if it meets the requirements for structural fill material.

2.04 FINAL BACKFILL OUTSIDE OF STRUCTURES, PAVEMENT, AND WALKS

- A. Fill and final backfill for utilities not under or immediately adjacent to structures, pavement prisms, and walks, shall be suitable non-structural fill material consisting of excavated material from the site, free of topsoil, debris, trash, roots, and other organic matter, frozen material, and stones larger than 3 inches in any dimension. If an adequate quantity of non-structural material is not available at the site, provide imported fill or borrow material consisting of any cohesive or granular material free from topsoil, debris, trash, roots, and other organic matter, frozen material, and stones larger than 3 inches in any dimension. The material shall not contain excessive moisture and shall readily compact and support construction equipment.
- B. Whenever the native excavated material is determined by the Engineer to be unsuitable, imported acceptable material, meeting the requirements for material within rights-of-way, and capable of attaining the required densities shall be used.

2.05 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide, with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires,

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foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in the table below and shall bear a continuous printed inscription describing the specific utility.

<u>Tape Color</u>	<u>Utility</u>
Red	Electric
Yellow	Natural Gas, Oil, Dangerous Material
Orange	Telephone, Telegraph, Television, Police and Fire Communications
Blue	Potable Water System
Green	Industrial and Sanitary Sewer
Green & White	Compressed Air

**PART 3 - EXECUTION**

3.01 PROTECTION

- A. Protect trees, shrubs, and lawn areas to receive planting, rock outcropping, and other features remaining as part of final landscaping.
- B. Protect bench marks and existing structures, roads, sidewalks, paving, and curbs against damage from vehicular or foot traffic.
- C. Protect excavations and workmen by shoring, bracing, sheet piling, underpinning, or by other methods, as required to prevent cave-ins or loose dirt from falling into excavations.
- D. Shore or otherwise support adjacent structure(s) which may be damaged by excavation work. This includes service lines, pipe chases, utilities, retaining walls, etc.
- E. Notify Engineer of any unexpected subsurface conditions. Discontinue work in the area until Engineer provides notification to resume work.

3.02 EXISTING UTILITIES

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- A. The drawings show existing utilities and their locations insofar as they are known. Utility locations and sizes may vary from those shown. Underground utilities or improvements may exist which have not been shown on the plans. All reasonable precautions shall be taken to field locate, preserve, and protect any and all such improvements.

Any improvements damaged by the Contractor which are not indicated by the drawings shall be repaired by the Contractor. Compensation for such repairs shall be covered by a Field Change Order and will be negotiated with the Engineer before corrections are made. Any such improvements damaged by the Contractor which are on the drawings shall be repaired at the expense of the Contractor.

- B. Request various agencies or utility companies concerned to field-mark substructures and utilities before excavating.
- C. Where it is necessary to remove, replace, or relocate such improvements in order to execute the Work, coordinate with, and obtain approval from the utility company or agency concerned.
- D. If the Contractor damages any existing utility lines that are not shown, or if the locations of suspected utilities are not known to the Contractor, report immediately to the Engineer and the Owner of the utilities.

3.03 TRENCH EXCAVATING

- A. Obtain required permits from local or state agencies.
- B. In areas requiring reseeding or sodding, strip topsoil to a minimum depth of 12 inches, or as directed by the Engineer, and stockpile away from trench and other excavated materials for reuse.
- C. Vertically cut existing pavement, sidewalk, curb and gutter, driveways, etc., along the lines forming the trench in such a manner as not to damage the adjoining pavement. Break up the portion to be removed, and remove from the site of the work immediately without causing damage to the pavement outside the limits of the trench.
- D. Perform trench excavation to the alignment and grade as shown on the drawings, or as required by the Engineer.
- E. As directed by the Engineer, when unsuitable foundation material is encountered at subgrade, remove unsuitable material and replace with foundation material. Contact Engineer prior to excavation of unsuitable material and placement of foundation material to gain authorization to do so.
- F. Place excavated material in a manner that will not endanger the work and will

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cause the least possible interference with public travel.

- G. Provide for uninterrupted flow of irrigation ditches, streams, wastewater, and storm drainage. Provide free access to all fire hydrants, water valves, meters, and drives.
- H. Keep excavation clear of water during the progress of the Work.
- I. The Contractor shall backfill, to existing grades, and barricade all trenches within roadways and parking areas at the close of each day, unless approved by the Engineer. No trenches shall be backfilled except in these areas until pipelines are properly tested.
- J. The use of a trench digging machine will be permitted except in places where machines may cause damage to existing structures, in which case, hand methods shall be employed.
- K. Place barriers along each excavation, at each end of excavations, along soft shoulder areas within roadways, and at other locations along the excavation as may be necessary or as required by the Engineer. Trenches shall be delineated night and day as required by applicable codes until backfilling is complete.
- L. Equipment with tracks which is to be used on pavement shall be equipped with suitable pads to prevent damage to the pavement. The Contractor shall be responsible for damage done to improved surfaces. Damaged surfaces shall be repaired or replaced by and at the expense of the Contractor in a manner satisfactory to the Engineer and at no additional cost to the Owner.
- M. Trenches, at the top of the initial backfill, shall be of necessary width for the proper laying of the pipe, but in no case shall the trench be less than 12 inches wider than the outside diameter of the pipe or more than two 2 feet wider than the pipe outside diameter.
- N. Trenches shall not be excavated until the pipe to be laid therein is on the site and is scheduled to be placed. The bottom of the trenches shall be accurately graded to a depth of 6 inches below the bottom of the pipe to allow for placing of granular pipe zone bedding material.  
  
Care shall be taken not to excavate below the depths indicated. Where bell and spigot pipe is used, the minimum cover depth shall be maintained over the bell as well as under the straight portion of the pipe. Over-excavation shall be backfilled in 6-inch lifts to the proper grade with foundation or bedding material, as required by the Engineer, and shall be thoroughly consolidated and compacted as specified at no additional cost to the Owner.
- O. Wasting of Material. Contractor shall remove and dispose of surplus, unsuitable and excess excavated material. Contractor shall secure waste sites for excess

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material. No additional payment shall be made for removal and disposal of material.

3.04 ROCK EXCAVATING

A. Rock shall be defined as follows:

1. Rock excavation shall consist of solid material and obstructions encountered with a volume in excess of 2 cubic yard. Sidewalks, pavement, and curb and gutter that cannot be excavated with a track-mounted power excavator (equivalent to Caterpillar Model No, 215C LC, rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull, and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at .81 cubic yard (heaped) capacity) without systematic drilling and blasting shall be excluded.
2. Hard and compact materials such as cemented gravels, glacial till, fractured quartzites, and relatively soft or disintegrated rock will not be considered as rock excavation. Rock excavation will not be considered as such because of intermittent drilling, blasting or ripping that is performed merely to increase production.

B. Excavation of the material claimed as rock shall not be performed until the material has been classified and cross-sectioned by the Engineer.

C. Rock payment lines are limited to the following:

Six (6) inches below invert elevation of pipe and two feet wider than inside diameter of the pipe, but not more than three (3) feet maximum trench width.

D. Excavate for and remove rock by the mechanical method.

1. Cut away rock at excavation bottom to form level bearing surface.
2. Remove shaled layers to provide sound and unshattered base for footings and foundations.
3. Remove excavated material.
4. For utility installations, cut away rock in bottom of trench to follow the proposed grade of the utility line. Eliminate sharp steps or protrusions.

E. Provide for visual inspection of bearing surfaces and cavities formed by removed rock.

F. Correct unauthorized rock removal in accordance with backfilling and compaction requirements of Section 02222.

3.05 STABILITY OF EXCAVATIONS

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- A. Slope sides of excavations to comply with OSHA 29 CFR Part 1926 or latest revision. Provide and install trench support systems where sloping is not possible because of space restrictions or stability of material excavated.
- B. Provide proper support for all excavations to protect life, property, utilities, pavement, and the Work and to provide safe working conditions in the trench in accordance with Occupational Safety and Health Administration (OSHA) regulations, *Federal Register* Vol. 37, No. 243, Subpart P., Sec. 1926.652 or latest edition.
- C. Contractor shall be responsible to determine when and where the use of trench support is employed over the use of trench boxes or sloping the sides of the excavation to the angle of repose of the material being excavated. Contractor shall be responsible for the support system used. Support systems shall be in accordance with Section 02160 - Excavation Support Systems.
- D. Remove all timber and sheeting from excavations or trenching before backfilling. Cut sheeting off 2-feet below final grade if allowed by Engineer.
- E. Contractor shall prevent damage to the existing improvements. Where existing improvements are damaged or affected as a result of the Contractor's work, the Contractor shall replace or repair such damage at no additional cost to the Owner.

3.06 DEWATERING

- A. Provide all equipment, labor, materials, tools, and incidentals necessary to design, construct, install, and operate dewatering facilities for construction of the Work.
- B. Do not discharge drainage water into storm drains unless approval by the governing agency and the Engineer is given. No discharge into sanitary sewers is allowed.
- C. Water shall not be allowed to flow through the pipe lines during construction.

3.07 BACKFILLING AND COMPACTING

- A. Assure that trenches are free of debris, snow, ice, and water and that ground surfaces are not in frozen condition.
- B. Backfill in a systematic manner and as soon as possible after pipeline installation and leak detection testing is complete.
- C. Compact materials in accordance with paragraph 3.14 Field Quality Control.

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- D. Foundation. When unstable earth, muck, or other foundation material is encountered in the excavation, additional excavation shall be made as directed by the Engineer, and shall be replaced with foundation materials. A minimum of 12 inches below the pipe zone will be removed and backfilled with foundation material to give a stable subgrade.

No additional payment for foundation material will be made unless the Engineer is notified of the condition and approves the use of foundation materials.

In rock excavation where over-excavation occurs the excavation shall be backfilled with foundation material to 6 inches below the pipe zone.

- E. Bedding and Pipe Zone. Place bedding material to required thickness and consolidate or compact. Shovel-slice or rod the bedding in the haunch area to assure that the pipe remains true to grade, voids are eliminated beneath the pipe, and the bedding is properly compacted or consolidated.
- F. Initial Backfill. Place and compact initial backfill material simultaneously on each side of the pipe for the full width of the trench in layers of 6 inches or less, to a point 12 inches over the top of the pipe and in such a manner as not to injure, damage or disturb the pipe.

G. Final Backfill.

- A. Under structures, pavement prisms, walks, and where specified by the Engineer, the backfill material shall be placed in continuous horizontal layers, not exceeding 6 inches in thickness or as required by Construction Manager. Adjust moisture content of fill or backfill material, as determined by ASTM D698, as necessary to  $\pm 2$  percent of optimum moisture as required to obtain specified degree of compaction. Utilize borrow material as available. Provide import structural fill material as required.
- B. In all areas outside of structures, pavement prisms, and walks, place non-structural fill or backfill material in continuous horizontal layers not exceeding 12 inches in thickness degree of compaction. Moisten or aerate native materials as necessary to  $\pm 1$  to 3 percent of optimum moisture as determined by ASTM D698.
- C. In areas where the pipe is placed near the existing ground surface, mound backfill material over pipe to a depth of 4 feet of cover, or as designated on the plans. Mounding shall be accomplished with consideration for drainage problems that may develop. Mounding shall only be used where shown on the plans.
- D. Distribute the backfill material in such a manner as to avoid the formation of lenses or layers of material differing substantially in characteristics from surrounding material. Do not include any roots, sod, frozen material or other perishable or unsuitable material in backfill.
- E. Whenever the excavated material is not suitable for backfill, furnish or transport from other

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areas within the project, suitable excavated material which meets the requirements for final backfill.

- F. Remove from site and dispose of excess or undesirable excavated material not suitable or required for backfill in an appropriate acceptable manner.
- G. Backfill for Appurtenances. After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for seven (7) days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be placed in such a manner as to prevent eccentric loading and excessive stress on the structure.

3.08 SPECIAL REQUIREMENTS

- A. Water Lines. Trenches shall be of a depth to provide a minimum cover of 5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.
- B. Electrical Distribution System. Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.
- C. Gas Distribution. Trenches shall be excavated to the depth that will provide not less than 36 inches of cover. Trenches shall be graded as specified for pipe-laying requirements.
- D. Plastic Marking Tape. Warning tapes shall be installed directly above the pipe at a depth of 18 inches below finished grade unless otherwise shown or required by the Engineer.

3.09 SOIL STORAGE (STOCKPILE) AREAS

- A. Prepare areas to receive stockpile material. Clear and grub as necessary to prevent stockpiled material from contamination with unsuitable material.
- B. Provide adequate drainage for stockpiles and surrounding areas by means of temporary ditches, dikes or other approved methods.
- C. Stockpile suitable excavated material in an orderly manner, and at a distance from the bank of the excavation sufficient to avoid overloading or cave-ins.
- D. Protect stockpiled material from contamination with unsuitable excavated material that may destroy the quality of the suitable stockpiled material. Replace stockpiled material, not adequately protected, that becomes unsuitable with suitable material at no cost to the Owner.

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- E. Do not place stockpile material in permanent fill material locations unless approved by the Engineer.
- F. When stockpile areas are no longer needed, prior to completion of the work, grade the stockpile area to original contours and abandon/fill temporary ditches.

3.10 BORROW AREAS

- A. Excavate borrow areas in such a manner as will afford adequate drainage.
- B. Transport overburden and spoils material to the designated spoil area or otherwise dispose of as directed by the Engineer.
- C. Operate borrow areas to minimize detrimental effects on natural environmental conditions.
- D. Maintain access roads as required to permit access.
- E. Slope sides of excavations or provide excavation support systems in accordance with Section 02160.
- F. Trim and drain borrow areas to neat lines after the excavation is complete.

3.11 COLD WEATHER

- A. Contractor shall remove and dispose of snow or ice from the construction area as necessary to perform the required work. The removal of additional deposits of snow shall not be cause for the Contractor to request an extension of contract time or additional payment.
- B. The Contractor shall provide cold weather protection materials and equipment, such as heaters and blankets, as required.
- C. Excavations, trenches, excavated material, and imported material shall be protected from frost or freezing, as necessary, until the excavation or trench has been backfilled.
- D. The presence of frozen material or material containing frost shall not be cause for the Contractor to request an extension of contract time or additional payment.
- E. The Contractor shall remove and dispose of frozen material that cannot be incorporated into the backfill.

3.12 FIELD QUALITY CONTROL

- A. Densities of in-place materials shall equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D698:

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<u>COMPACTION REQUIREMENTS</u>		
Location or Use of Fill	Percentage of Maximum Density	
Foundation, bedding, and initial trench backfill or fill material	96	
Final fill and backfill beneath structures, paved areas (including sidewalks and gravel roadways)	96	
Final fill and backfill, not beneath paved areas or structures	90	
Topsoil	80	
Overexcavation	95	

B. Passing overexcavation tests are required on the fills and backfills at the following frequencies:

- Bedding - 1 Test per 200 L.F. of Trench
- Initial Backfill - 1 Test per 200 L.F. of Trench
- Final Backfill or Fill (outside pavement section) - 1 Test per 200 L.F. of Trench per lift
- Final Backfill or Fill (under pavement section) - 1 Test per 50 L.F. of Trench per lift
- Overexcavation - 1 Test per 50 L.F. of Trench per lift

C. Densities of in-place material shall be as determined by ASTM D2922.

D. Compaction tests not meeting specification requirements shall be retested, after recompaction, at Contractor's expense. The Engineer shall select the depth that the test is to be taken. The Contractor shall be responsible to dig all density testing pits at the location and depth requested. No additional payment will be made for test pits dug for compaction tests or for replacing and recompacting the backfill material.

E. Fill or backfill not compacted to the required density will be removed, recompacted, and retested at the Contractor's expense until the requirements are met. The retesting shall be at the Contractor's expense.

F. Any trenches and excavation pits improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction, rounded over, and smoothed off or pavement sections restored.

G. The Contractor shall be responsible for providing Proctor Density test results for backfill material, bedding material, and any special import backfill used. Prior to

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commencement of any construction the Contractor shall obtain samples of backfill material for Proctor tests. Where existing material is to be used as backfill material the Contractor shall be responsible for providing the machinery and labor to obtain soils samples of the backfill material for Proctor tests. On this project at least one sample per 1000 feet of pipe to be installed shall be required.

Additional Proctor tests may be required if backfill material changes in characteristics. Proctor tests shall be run by a Owner-approved testing laboratory. The cost of obtaining soil samples and conducting Proctor tests shall be paid by the Contractor.

No pipeline installation will begin until written results of the Proctor tests for that area have been submitted to the Engineer. The Contractor shall use the Proctor test results for testing compaction of backfill material.

3.13 LIMITS OF CONSTRUCTION

The Contractor shall complete all work within the easement lines and rights-of-way as shown on the drawings or as directed by the Engineer. All corrections for disturbance, damage, or irregularity shall be the responsibility of the Contractor and shall hold the Owner harmless of all suits, liability and damages. All ditches, canals, and roadways shall be placed back into their original or better condition.

3.14 CLEAN UP

- A. Remove all excess material, debris, sheeting, etc. from the site upon completion of the Work and dispose of properly.
- B. Keep cleanup operations to within 500 feet of excavation at all times.
- C. Failure to keep the cleanup operations to within 500 feet of excavation shall be sufficient cause for the Engineer to stop forward progress of excavating equipment and hold progress payments until the cleanup is up to acceptable limits and standards.
- D. Any pavement, trees, shrubbery, fences, poles, or other property or structures damaged, removed, or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances or the specific direction of the Engineer or through failure to employ usual and reasonable safeguards shall be replaced or repaired at the expense of the Contractor.

**END OF SECTION 02222**

**SECTION 02230**

**SITE CLEARING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

- B. Related Sections include the following:

1. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
3. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
4. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.
5. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
6. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.

1.3 DEFINITIONS

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- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings according to Division 1 Section "Contract Closeout."
  - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

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- D. Notify utility locator service for area where Project is located before site clearing.

**PART 2 - PRODUCTS** (Not Applicable)

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

**PART 3 - EXECUTION**

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
  - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.

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- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
  - 1. Cover exposed roots with burlap and water regularly.
  - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
  - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
  
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.
  - 1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
  - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.3 UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
  
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.

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- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 15 mechanical or Division 16 electrical Sections.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of **18 inches** below exposed subgrade.
  - 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding **8-inch** loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Limit height of topsoil stockpiles to **72 inches**.
  - 2. Do not stockpile topsoil within drip line of remaining trees.
  - 3. Dispose of excess topsoil as specified for waste material disposal.
  - 4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

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3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

**END OF SECTION 02230**

**SECTION 02710**  
**WATER DISTRIBUTION**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section includes water-distribution piping and specialties outside the building for the following:
1. Water services.
  2. Fire-service mains.
  3. Combined water service and fire-service mains.
  4. Aboveground water piping for applications other than water-service piping.

1.02 SUBMITTALS

- B. Product Data: For the following:
1. Valves and accessories.
  2. Water meters and accessories.
  3. Backflow preventers and assemblies.
  4. Fire hydrants.
  5. Fire department connections.
- C. Wiring Diagrams: Power, signal, and control wiring.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For the following:
1. Water meters.
  2. Valves.
  3. Backflow preventers.
  4. Protective enclosures.
  5. Hydrants.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

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2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF- pw" on piping.
  2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.

1.4 COORDINATION

- A. Coordinate connection to water main with utility company.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS  
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- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    - a. Gaskets: AWWA C111, rubber.
- C. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.
1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

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- D. PE, ASTM Pipe: ASTM D 2239, SDR Numbers 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 200 psig.
  - 1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.
  - 2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- E. PVC, Schedule 40 Pipe: ASTM D 1785.
  - 1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.
- F. PVC, Schedule 80 Pipe: ASTM D 1785.
  - 1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
- G. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.
  - 1. Comply with UL 1285 for fire-service mains if indicated.
  - 2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
  - 3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.4 JOINING MATERIALS

- A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Soldering Flux: ASTM B 813, water-flushable type.
- D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

2.5 VALVES

- A. AWWA, Cast-Iron, Gate Valves:
  - 1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

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- a. Minimum Working Pressure: 200 psig.
  - b. End Connections: Mechanical joint.
  - c. Interior Coating: Complying with AWWA C550.
2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
- a. Minimum Working Pressure: 200 psig.
  - b. End Connections: Mechanical joint.
  - c. Interior Coating: Complying with AWWA C550.
- B. UL/FM, Cast-Iron Gate Valves:
1. UL/FM, Nonrising-Stem Gate Valves: UL 262, FM-approved iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
    - a. Minimum Working Pressure: 175 psig.
    - b. End Connections: Flanged.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.
1. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
  2. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch- diameter barrel.
1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

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2.7 CORPORATION VALVES AND CURB VALVES

- A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
  - 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
  - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
- B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch- diameter barrel.
  - 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.8 WATER METERS

- A. Description: AWWA C700, displacement-type, bronze main case. Register flow in gallons unless cubic feet are indicated.
- B. Description: AWWA C702, compound-type, bronze case. Register flow in gallons unless cubic feet are indicated.
- C. Water-Meter Boxes: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.

2.9 BACKFLOW-PREVENTION DEVICES

- A. General: ASSE standard, backflow preventers.
  - 1. Working Pressure: 150 psig minimum, unless otherwise indicated.
  - 2. NPS 2 and Smaller: Bronze body with threaded ends.
  - 3. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
    - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
  - 4. Interior Components: Corrosion-resistant materials.

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5. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
- B. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013 or AWWA C511, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves.
  1. Maximum Pressure Loss: 12 psig through middle 1/3 of flow range.
- D. Double-Check-Valve Backflow Prevention Assemblies: ASSE 1015 or AWWA C510, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.
  1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range. Retain paragraph and subparagraph above or below.
- E. Double-Check-Valve Backflow Prevention Assemblies: UL 312, FM approved; with two UL 312, FM-approved, iron-body, 175-psig working-pressure, flanged-end check valves and two UL 262, FM-approved, iron-body, outside screw and yoke, flanged, 175-psig working-pressure gate valves.
  1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.
- F. Units in paragraph below are for moderate to high hazard and are available in NPS 1/2 to NPS 2 (DN 15 to DN 50).
- G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
  1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

2.10 FREESTANDING FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

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- B. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.
1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
  2. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
  3. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
  4. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.11 FIRE DEPARTMENT CONNECTIONS

- A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.
1. Connections: Two NPS 2-1/2 inlets and one NPS 4 NPS 6 outlet.
  2. Connections: Three NPS 2-1/2 inlets and one NPS 6 outlet.
  3. Inlet Alignment: Inline, horizontal .
  4. Finish Including Sleeve: Polished chrome plated Rough chrome plated Polished bronze.
  5. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

**PART 3 - EXECUTION**

3.1 PIPING APPLICATIONS

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.
- B. Underground Water-Service Piping: Use any of the following piping materials for each size range:
1. NPS 3/4 to NPS 2: Soft copper tube, Type K Type L; wrought-copper fittings; and brazed soldered joints.
  2. NPS 3/4 to NPS 2: PVC, PVC, Schedule 80 socket fittings; and solvent-cemented joints.
  3. NPS 2-1/2 to NPS 3-1/2: Soft copper tube, Type K ; wrought-copper fittings; and brazed soldered joints.

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4. NPS 2-1/2 to NPS 3-1/2: PVC, PVC, Schedule 80 socket fittings; and solvent-cemented joints.
  5. NPS 4 to 16: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
  6. NPS 4 to 16: PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.
- C. Underground Fire-Service-Main Piping: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints. Or if shown on plan, PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.
- D. Underground Combined Water-Service and Fire-Service-Main Piping: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints. Or if shown on plan, PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

### 3.2 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient seated, gate valves with valve box.
  2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

### 3.3 JOINT CONSTRUCTION

- A. See Division 2 Section "Utility Materials" for basic piping joint construction.
- B. Make pipe joints according to the following:
1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

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3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

### 3.4 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
  1. Install tapping sleeve and tapping valve according to MSS SP-60.
  2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Make connections NPS 2 and smaller with drilling machine according to the following:
  1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
  2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
  3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
  4. Install corporation valves into service-saddle assemblies.
  5. Install manifold for multiple taps in water main.
  6. Install curb valve in water-service piping with head pointing up and with service box.
- E. Comply with NFPA 24 for fire-service-main piping materials and installation.

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- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- G. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- H. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- I. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- J. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration.
- K. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
  - 1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.
- L. Sleeves are specified in Division 2 Section "Utility Materials."
- M. Mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- O. Anchor service-entry piping to building wall.

3.5 ANCHORAGE INSTALLATION

- A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
  - 3. Fire-Service-Main Piping: According to NFPA 24.
  - 4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

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- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 WATER-METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written requirements.
- B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water-meter inlets. Include valves on water-meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.
- C. Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water-meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
- D. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.8 BACKFLOW-PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.9 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

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- C. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install fire department connections of types and features indicated.
- B. Install ball drip valves at each check valve for fire department connection to mains.
- C. Install protective pipe bollards on two sides of each freestanding fire department connection. Refer to Division 5 Section "Metal Fabrications" for pipe bollards.

3.11 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.
- B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- D. Connect water-distribution piping to interior domestic-water and fire-suppression piping.
- E. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer piping.
- F. Connect waste piping from drinking fountains to storm-drainage system. See Division 2 Section "Storm Drainage" for connection to storm-sewer piping.
- G. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum

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allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

- C. Prepare reports of testing activities.

3.13 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.
- B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.14 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
  - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

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**END OF SECTION 02710**

**SECTION 02810**

**IRRIGATION**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK:**

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:

- A. Procurement of all applicable licenses, permits, and fees.
- B. Coordination of Utility Locates ("Call Before You Dig").
- C. Verify with the appropriate water district on the location of the water service main line and complete all requirements to bring water service to the site.
- D. Coordination for, and connection to, electrical power supply for the irrigation controller.
- E. Maintenance period.
- F. Sleeving and conduit for irrigation pipe and wire.

**1.02 RELATED SECTIONS:**

- A. Division 2-Site Work:
  - 1. Section 02913 – Turf Sod and Soil Preparation
  - 2. Section 02950 – Plant Material

**1.03 SUBMITTALS:**

- A. Deliver five (5) copies of all submittals to the Construction Project Representative within 15 days from the date of Notice to Proceed. Contractor will be limited to one re-submittal for approval of all substitution requests.
- B. Materials List: Include pipe, fittings, mainline components, water emission components, 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.
- 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.

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**1.04 RULES AND REGULATIONS:**

- A. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, 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.

**1.05 TESTING:**

- A. Notify the Construction Project Representative three days in advance of testing.
- B. Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall 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 Construction Project Representative.
- D. Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.
- E. Hydrostatic Pressure Test:
  - 1. Subject solvent-weld mainline pipe to a continuous hydrostatic pressure equal to 150 PSI for two hours. Test with mainline components installed.
  - 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.
  - 4. Cement or caulking to seal leaks is prohibited.
- F. Volumetric Leakage Test:
  - 1. Backfill to prevent pipe from moving under pressure. Expose couplings and fitting.
  - 2. Purge all air from the pipeline before test.
  - 3. Subject gasketed mainline pipe to an operating pressure of 150 PSI for two hours. Maintain constant pressure. The amount of additional water pumped in during the test shall not exceed 1.52 gallons per 100 joints of 3-inch diameter pipe, 1.96 gallons per 100 joints of 4-inch diameter pipe, and 2.90 gallons per

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100 joints of 6-inch diameter pipe. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.

4. Cement or caulking to seal leaks is prohibited.

G. Operational Test:

1. Activate each remote control valve in sequence from controller. The Construction Project 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, or move water emission devices to correct operational or coverage deficiencies.
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 passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.

**1.06 GUARANTEE/WARRANTY AND REPLACEMENT:**

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

- A. For a period of one year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within seven days of notification from the Construction Project Representative.
- B. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.
- C. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

**PART 2 - PRODUCTS**

**QUALITY:**

Use materials which are new and without flaws or defects of any type, and which are the best of their class and kind.

**SUBSTITUTIONS:**

- A. Acceptable equipment manufacturers are specified on the drawings and details. Alternative equipment must be approved in writing as specified in the General Conditions. The Contractor is responsible for making any changes to the design to accommodate alternative equipment.

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

**2.03 SLEEVING:**

- A. Install separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
- B. Use PVC Schedule 40 pipe with solvent welded joints for sleeving material beneath pedestrian pavements, drives and streets.
- C. Sleeving diameter is as indicated on the drawings and installation details or equal to twice that of the pipe or wiring bundle passing through the sleeve.

**2.04 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 the dimensions and tolerances established by ASTM Standard D2241 for mainline pipe with a nominal diameter greater than or equal to 3-inches.
3. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe with a nominal diameter greater than or equal to 3-inches. Gasketed pipe joints must conform to the "Laboratory Qualifying Tests" section of ASTM D3139. Gasket material must conform to ASTM F477. Use rubber-gasketed deep bell ductile iron fittings conforming to ASTM A-536 and ASTM F-477 or Harco ductile iron fittings. Use lubricant approved by the pipe manufacturer.
4. Use solvent weld pipe Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D1785 for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve.
5. Use Schedule 80, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for solvent weld pipe Schedule 40. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
6. Epoxy coated double strap saddles, M.J. tees, schedule 80 S tees with SXT schedule 80 bushings or Harco ductile iron service tees are approved on PVC main lines for automatic control valve installation.

B. 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.
2. Use Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D1785.

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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. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer.

C. Specialized Pipe and Fittings:

1. Copper pipe: Use Type "K" rigid pipe conforming to ASTM Standard B88. Use wrought copper or cast bronze fittings, soldered or threaded per the installation details. Use a 95% tin and 5% antimony solder.
2. Ductile iron pipe: Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use a minimum of Class 53 thickness pipe for flanged piping. 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. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).
4. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 80 threaded fittings.
5. Joint sealant: Use only teflon-type tape or teflon based paste pipe joint sealant on plastic threads as recommended by valve or fitting manufacturer. Use nonhardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.

D. Thrust Blocks:

1. Use thrust blocks for fittings on mainline pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.
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.

E. Joint Restraint Harness:

1. Use a joint restraint harness wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
2. Use a joint restraint harness with 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 bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials which are zinc plated or galvanized.
4. Use on mainline pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.

**2.05 MAINLINE COMPONENTS:**

A. Master Valve Assembly: as presented in the irrigation schedule.

B. Isolation Gate Valve Assembly:

Gate valves shall conform to AWWA specification C 509. They shall be of Class 200 cast iron body, resilient-seated waterous brand and shall have a non-rising stem with rubber "O" rings. Stems shall be of cold rolled, solid bronze, high tensile

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strength. Valve shall be high strength cast iron, fully encapsulated urethane rubber wedge. Gate valves shall be hydrostatically pressure tested for 400 P.S.I and shall be designated for a working pressure of 200 P.S.I.

Gate valves shall be same size as main line. Valves 2" and larger shall have flanged end connections. Valves 1-1/2" and smaller shall have threaded end connections, non-rising stem. Buried valves shall have 2" square operating nut. No handles or wheels will be permitted. Valves inside structures shall have wheel handles. Unions shall be installed on each side of all valves except flanged valves. Each valve shall contain a resilient wedge urethane rubber seat.

C. Quick Coupling Valve Assembly:

6. Installed with double swing joint arrangement as presented in the installation details.
7. Each valve shall be a Rainbird 44 LRC heavy duty brass, two-piece, single lug locking cap. Double swing joint arrangement shall be galvanized iron pipe.
8. Quick coupler valves shall be installed within a 10" round valve box.
9. Contractor shall provide to the Owner at least 1 cap lock key and 1 quick coupling key with a swivel hose bib attached. These keys shall be delivered prior to final acceptance of the project.

D. Backflow Prevention: as presented in the irrigation schedule.

E. Manual Drain Valve:

1. All manual drains shall be Ford B11333 heavy duty brass, ball valve.
2. Each manual drain valve will be accessed by a 2 inch P.V.C. Schedule 40 pipe sleeve, capped by a Weathermatic 906L locking valve cap with a RLK-1 key enclosed within a 10" valve box.
3. Automatic drain valves shall not be used.

**2.06 SPRINKLER IRRIGATION COMPONENTS:**

A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals: as presented in the irrigation schedule.

1. Use remote control valves with pressure regulating features for all pop-up spray sprinkler or bubbler laterals. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags, or approved equal, with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.
2. All pipe on the control valve manifolds shall be Schedule 80 P.V.C. pipe.
3. All control wire connections made inside the box to the valve shall be 3M-DBY connector.

B. Sprinkler Assembly: as presented in the drawings and installation details. Use the sprinkler manufacturer's pressure compensating screens to achieve 30 PSI operating conditions on each spray sprinkler and to control excessive operating pressures.

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- C. Control Wire:
  - 1. Use American Wire Gauge (AWG) No. 14-1 solid copper, Type UF or PE cable, UL approved for direct underground burial for individual control wires and spare control wires from the controller unit to each remote control valve or stub-out location. Use American Wire Gauge (AWG) No. 12-1 solid copper, Type UF or PE cable, UL approved for direct underground burial for common ground wire and spare common wires from the controller unit to each remote control valve or stub-out location.
  - 2. Color: Wire color shall be continuous over its entire length. All common or ground wires shall be White. Where more than one controller is required, a different color hot wire shall be used for each controller. Spare wires shall also be a different color from the regular wires.
  - 3. Splices: Use 3M-DBY wire connector with waterproof sealant.
  - 4. All splices shall be housed in a valve box.
- D. Controller: as presented in the drawings. Provide surge protection at the incoming power and low voltage power side grounding.

**2.07 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 which are part of the irrigation system, even though such items may not have been referenced in these specifications.

**PART 3 - EXECUTION**

**3.02 INSPECTIONS AND REVIEWS:**

- A. Site Inspections:
  - 1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the Construction Project Representative prior to beginning work.
  - 2. Verify the water pressure on main water line provided for irrigation system. Notify the Landscape Architect if the water pressure is under 40 psi or over 80 psi and may effect the design of the irrigation system.
  - 3. 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.
  - 2. Repair any underground utilities damaged during construction. Make repairs at no additional cost to the contract price.

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- C. Irrigation System Layout Review: Irrigation system layout review will occur after the staking has been completed. Notify the Construction Project Representative two weeks in advance of review. Modifications will be identified by the Construction Project Representative at this review.

**3.03 LAYOUT OF WORK:**

- A. Stake out the irrigation system. Items staked include: sprinklers, pipe and wire routing, control valves, isolation valves, sleeving and conduit.
- B. Install all mainline pipe and mainline components inside of project property lines.

**3.04 EXCAVATION, TRENCHING, AND BACKFILLING:**

- A. Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.
- B. All trench bottoms shall be sloped so that the pipe will gravity drain back to the main connection point or the nearest manual drain.
- C. Minimum cover (distance from top of pipe to finish grade):
  - 1. 36-inch over electrical conduit.
  - 2. 18-inch over mainline pipe.
  - 3. 12-inch over lateral pipe.
  - 4. 18-inch over sleeved control wires.
  - 5. 18-inch for sleeves under driveways and parking areas.
- D. Trenches for irrigation lines shall be a minimum of 6 inches away from sidewalks or curbs.
- E. If more than one line is required in a single trench, that trench shall be deep and wide enough to allow for at least 6 inches of separation between pipes.
- F. No backfilling of trenches shall be done until the system has been inspected for proper trench depths, installation of equipment, control wire, and location of heads by Landscape Architect.
- G. Before trenches are backfilled, the Contractor must show redlined "as built" drawings where changes have been made.
- H. Backfill with a 2-inch min. sand envelope of fine masonry sand completely surrounding all mainline pipe and fittings.
- I. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetable matter, frozen materials, and stones larger than 2-inches in maximum dimension. Remove from the project site material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects which may damage the pipe. In lawn areas, the top 4 inches of backfill shall be topsoil.

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- J. Backfill unsleeved pipe in either of the following manners:
  - 1. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.
  - 2. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting to the density of surrounding soil.
- K. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.
- L. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
- M. Where utilities conflict with irrigation trenching and pipe work, contact the Construction Project Representative for trench depth adjustments.

**3.05 SLEEVING AND BORING:**

- A. Install sleeving at a depth which permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes.
- C. Use one water pipe maximum per sleeve. Sleeve control wiring in separate sleeve.
- D. Bore for sleeves under obstructions which cannot be removed. Employ equipment and methods designed for horizontal boring.

**3.06 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.
  - 3. All tees coming out of main lines, lateral lines, valves and other fixtures shall be horizontal so that no weight or pressure may be exerted on the top or bottom of the irrigation line.
  - 4. 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 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.

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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"

B. Irrigation Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. 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 shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.
3. PVC Solvent Weld Pipe:
  - a. Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
  - b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
4. Fittings: The use of cross type fittings is not permitted.

C. Specialized Pipe and Fittings:

1. Copper Pipe:
  - a. Buff surfaces to be joined to a bright finish. Coat with solder flux.
  - b. Solder so that a continuous bead shows around the joint circumference.
2. Ductile Iron Pipe:
  - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
3. Insert a dielectric union wherever a copper-based metal (copper, brass, bronze) and an iron-based metal (iron, galvanized steel, stainless steel) are joined.
4. PVC Threaded Connections:
  - a. Use only factory-formed threads. Field-cut threads are not permitted.
  - b. Use only Teflon-type tape or teflon based paste.
  - c. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female

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threads.

5. Make metal-to-metal, threaded connections with Teflon-type tape or pipe joint compound applied to the male threads only.
6. The ends of all galvanized pipe shall be reamed and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-1/8 times the length of the female thread receiving the pipe.

D. Thrust Blocks:

1. Install thrust blocks at all changes of direction at tees and angles as shown on details. Install thrust blocks at dead ends and valves at which thrust develops when closed.
2. Use cast-in-place concrete bearing against undisturbed soil. As a general rule, one cubic foot (minimum) of class AA(AE) Type II concrete is required for each thrust block.
3. Orientation and placement shall be as shown on the installation details.
4. Wrap fitting with plastic to protect bolts, joint, and fitting from concrete.
5. Where a fitting is used to make a vertical bend, use a bar to anchor the fitting to a thrust block.

E. Joint Restraint Harness:

1. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices.

**3.07 INSTALLATION OF MAINLINE COMPONENTS:**

A. Isolation Gate Valve Assembly:

1. Install where indicated on the drawings.
2. Locate at least 12-inches from adjacent walls or edges of paved areas.
3. All main line gate valves shall be fitted with a 6" minimum diameter pipe sleeve and 10" round bolt down valve box.

B. Quick Coupling Valve Assembly: Install where indicated on the drawings and as per detail.

C. Backflow Prevention: Install where indicated on the drawings behind the point of connection (down stream) to the supplying utility line and shall comply with local water district or State (whichever is most restrictive) requirements.

D. Manual Drain Valve:

1. Install at all low points in the main lines.
2. Location of each manual drain shall be shown on the "as built" drawings.
3. Each manual drain valve will be accessed by a 2 inch P.V.C. Schedule 40 pipe sleeve, capped by a Weathermatic 906L locking valve cap with a RLK-1 key enclosed within a 10" valve box.

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4. Top of drain sleeve to be 3"- 6" below lid of valve box.
5. Each manual drain shall have a gravel sump, a minimum of 18" by 18" by 12" deep. The gravel shall be washed 3/4 inch rock. No pea gravel will be allowed.

**3.08 INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS:**

A. Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals:

1. Flush mainline before installation of RCV assembly.
2. Install where indicated on the drawings.
3. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Install connectors and sealant per the manufacturer's recommendations.
4. Install only one control valve to a valve box.
5. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Arrange grouped valve boxes in rectangular patterns. Allow at least 12-inches between valve boxes. Set cover of valve box even with finish grade.
6. No valve box shall rest directly upon the valve or any fixture associated with it.
7. Each valve box shall be centered on the valve it covers. Install valve no more than 12-inches below finished grade.
8. Each valve box shall have 6 inches of pea gravel placed in the bottom underneath the valve and lines.
9. Adjust RCV to regulate the downstream operating pressure.
10. Attach ID tag with controller station number to control wiring.

B. Sprinkler and Bubbler Assembly:

1. Flush lateral pipe before installing sprinkler and bubbler assembly.
2. Install irrigation heads at locations shown on the drawings.
3. Rotary pop-up heads shall be installed on double swing joints as per detail. All swing joints must drain by gravity back to the supply lines.
4. Pop-up spray heads shall be installed on flexible swing pipe as per detail.
5. Locate rotary sprinklers 6" from adjacent walls, fences, or edges of paved areas.
6. Locate spray sprinklers 3" from adjacent walls, fences, or edges of paved areas.
7. Install sprinklers and bubblers perpendicular to the finish grade.
8. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance and coverage uniformity.
9. Adjust the radius of throw of each sprinkler for best performance and coverage uniformity.
10. Prior to final acceptance of the project, all heads shall be raised or lowered to final lawn or planting grade.

**3.09 INSTALLATION OF CONTROL SYSTEM COMPONENTS:**

A. Control Wire:

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals.

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2. Two spare wires shall be run from each controller to the farthest valve under its control in all directions and any valve which is on a dead-end line and shall be labeled at both ends. Each spare wire shall be brought up to the surface in each valve box it passes through and coiled with 24 inches for future use. Each spare wire shall be tested for continuity prior to final acceptance of the project.
3. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90 degree change of direction, at each splice, 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 a valve box which contains an irrigation valve assembly, or in a separate 10-inch round valve box. Use same procedure for connection to valves as for in-line splices.
6. Unless noted on plans, install wire parallel with and below mainline pipe.
7. Encase all wire in conduit or sleeves not installed with PVC mainline pipe, as well as wire that crosses under water, attached to bridges, and under all pavement. All out of ground conduit shall be metal rigid conduit. All buried conduit can be P.V.C. conduit.
8. Sleeve sizes shall be as follows: 1-11 wires in 1-1/4" pipe; 12-15 wires in 1-1/2" pipe; etc...

B. Controller:

1. Install where indicated on drawings and in accordance with manufacturer's recommendations.
2. It shall be the Contractor's responsibility to install and supply a plugged outlet, junction box or separate breaker to furnish power to a new controller to make the controller operational and in compliance with local electrical codes.
3. Surge protection shall be provided at the incoming power and low voltage power side grounding as per national electrical code. Bond ground rods when more than one is used.

**3.10 INSTALLATION OF OTHER COMPONENTS:**

A. Tools and Spare Parts:

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

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

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**3.11 PROJECT RECORD (AS-BUILT) DRAWINGS:**

- A. The Contractor is responsible for documenting changes to the design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.
- B. Record pipe and wiring network alterations. Record work which is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller or control unit, each manual drain, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box.
- C. Prior to construction completion, obtain from the Construction Project Representative a reproducible mylar copy of the drawings. The "as-built" information shall be permanently recorded on the mylar copies.
- D. Turn over the "Record Drawings" to the Construction Project Representative. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.

**3.12 MAINTENANCE:**

- A. Upon completion of construction and Review by the Construction Project Representative, maintain irrigation system for a duration of 30 calendar days. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.
- B. In the Fall of the year during the installation and guarantee period, the Contractor shall winterize the system by draining all of the water and doing everything necessary to insure protection of the system until Spring. Blowing out the lines by compressor shall be permitted during the one year guarantee.
- C. Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

**3.13 CLEANUP:**

- A. Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish.

**3.14 FINAL INSPECTION:**

- A. At the end of the guarantee period, when the lawn and landscaping have been approved, the Contractor shall call for a final inspection of the sprinkler irrigation system. There

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shall be 5 days notice given, in writing, to the Landscape Architect, prior so that the appropriate people may attend.

- B. Prior to that time, all heads shall have been adjusted to their proper pattern, radii, and height. The system will have been flushed out, checked for operation, and any defects corrected. A final list of items found in need or correction (if any), will be made and the Contractor shall correct them. Upon acceptance of the system, the Owner shall assume all responsibility for the system.

**END OF SECTION 02810**

**SECTION 02913**

**TURF SOD AND SOIL PREPARATION**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

A. Related Sections:

02810 – Irrigation System  
02950 – Plant Material

B. The Work under this Section shall consist of furnishing all labor, materials and incidentals needed to install topsoil and turf grass in accordance with these Specifications.

**1.02 QUALITY ASSURANCE**

A. Comply with federal, state and local laws requiring inspection for plant disease and infestations. Inspection certificates required by state law shall accompany each shipment and be delivered to the Construction Project Representative.

B. Personnel: Employ only qualified personnel familiar with required work.

**1.03 SUBMITTALS**

A. Product Data: The Contractor shall submit as part of the project submittal package, three (3) complete sets of the supplier's guaranteed statement of:

1. Composition, mixture, percentage of purity and germination for variety of sod, specified herein for approval by the construction project representative.
2. Certificate of lawn fertilizer.
3. Laboratory analytical data of imported topsoil (if required).

**PART 2 - PRODUCTS**

**2.01 TOPSOIL**

A. Topsoil will be provided by the Contractor. The intent is for the Contractor to use stockpiled on-site topsoil or imported topsoil if on-site topsoil does not meet topsoil quality guidelines. Contractor will be responsible for placement and

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amendment to topsoil and planting soils. Contractor shall have agronomy soils test performed on any proposed imported soil. Test results shall be submitted to Landscape Architect for approval.

- B. Contractor shall bid the project with the following topsoil quality guidelines as outlined below. Should test results of on site topsoil not meet the specified guidelines, the contractor may amend the on-site topsoil or import new topsoil.
- C. Topsoil shall be used for all new turf areas and as part of the backfill mix for all container planting.
- D. Topsoil shall consist of friable soil of loam character. It shall be obtained from well-drained arable land and shall be free from sub-soil, refuse, roots, heavy or stiff clay, stones 1 inch and larger, in largest dimension, coarse sand, sticks, brush, litter, and other deleterious substances.

Requirements for topsoil shall be as follows:

TOPSOIL QUALITY GUIDELINES

Category	pH	Soluble Salts dS/m or mmho/cm	Sodium Absorption Ratio (SAR)	Organic Matter %	Sand %	Silt %	Clay %
Ideal	5.5-7.5	<2	<3	≥2.0	<70	<70	<30
Acceptable	5.0-8.2	<4	3 to 10	≥ 1.0	<70	<70	<30
Unacceptable	<5.0 >8.2	>4	>10	<1.0	>70	>70	>30

**2.02 SOD**

- A. Provide sod of uniform pad sizes with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own height when suspended vertically with a firm grasp on upper 10% of pad will be rejected.
- B. Varieties

Kentucky Bluegrass blend.

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- C. A full and healthy stand of grass shall be actively growing.
- D. Each grass type shall only come from one (1) farm location. If additional sources for each grass type is needed due to availability from original source, contractor shall submit proof (soils analysis) that the farm has similar soil type for growing sod (item E).
- E. Sod shall be farm-grown on a sand base soil type. (No Clay loam soil sources shall mix with sandy loam soil sources).
- F. If the sod for each grass type comes from more than one location, during the submittal phase, the contractor shall submit a map or diagram of the project site to the Landscape Architect proposing where the sod sources will be installed on site; grouping the same sod sources together.

**2.03 FERTILIZER**

- A. Fertilizer shall be a complete mixture, analyzing sixteen (16)% Nitrogen; sixteen (16)% Phosphoric Acid; and eight (8)% Pot Ash, of commercial type and applied at a rate of six (6) pounds per thousand (1000) square feet of area.

**PART 3 – EXECUTION**

**3.01 PREPARATION OF SOILS**

- A. Report any unusual subsoil condition that will require special treatment to the Landscape Architect.
- B. Loosen subgrade of lawn areas to a minimum depth of 4". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas that will be planted promptly after preparation.
- C. Surface drainage shall be insured and, if shown, shall be directed in the manner indicated on the drawings by grading surface to facilitate the natural run-off water. Fill low spots and pockets with topsoil and grade to drain properly.
- D. The Contractor shall furnish and spread 4" topsoil on sodded areas or as required to meet lines, grades and elevations shown, after light rolling and natural settlement. Finish grade of all lawn areas shall be 1-1/2" below grade of adjacent pavement of any kind.
- E. Finish grading shall consist of placing soil, and tilling of lawn areas as specified. After tilling, bring areas to uniform grade by floating or hand raking. Make minor

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adjustments of finish grades at the direction of Landscape Architect.

- F. All rocks 1" and larger and non-conforming foreign matter such as building rubble, wire, cans, sticks, etc., shall be removed from topsoil during finish grading.
- G. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
- H. Allow for sod thickness in areas to be sodded.
- I. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 2" of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.
- J. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
- K. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
- L. Amendments, if required, shall be incorporated only into topsoil by roto-tilling or disking to form a homogeneously blended mix. Do not mix with the existing site subsoil layer.
- M. The amended topsoil shall then be placed, water settled, re-graded, and brought to finish grades at a compaction rate of 80% to 85% optimum moisture content. Add additional amended topsoil as needed to insure minimum depth requirement.

### 3.02 SOD INSTALLATION

- A. Sod shall be laid within 24 hours from the time of stripping. Dormant sod shall not be used nor shall sod be laid if ground is frozen.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or lightly roll to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess material from sodden areas to prevent smothering. Anchor sod on slopes with wood dowels to prevent slippage.
- C. Thoroughly water sod with a fine spray immediately after planting to saturate the

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sodden area to a depth of four inches.

- D. No sodding shall be done immediately after a rain storm or if a prepared surface has been compacted without first loosening the surface to a smooth, loose, uniformly fine texture just prior to sodding.

**3.03 CARE AFTER SOD INSTALLATION**

- A. After application, the Contractor shall not operate equipment or walk over the covered area.
- B. The Contractor shall determine routine watering schedules.
- C. Keep all areas moist. During the first 10 days, it may be necessary to irrigate several times per day to prevent dry-out. Evenly water, but prevent runoff.
- D. Mow grass at regular intervals to maintain at maximum height of 2 inches.
- E. Neatly trim all edges and hand clip where necessary.
- F. Immediately remove clippings from sodden areas after mowing and trimming.
- G. Application of herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
- H. Immediately replace sod in areas which show deterioration, brown or bare spots.

**3.04 INSPECTION**

- A. Pre-Inspection Walk-Through
  - 1. Notify construction project representative 48 hours in advance to schedule pre-inspection.
  - 2. Work of this section shall be completely installed prior to scheduling of walk-through.
  - 3. Generate a "punch list" of items to be corrected, prior to Final Inspection for Substantial Completion.
  - 4. Furnish all required material and equipment and perform all work required to correct deficiencies.
- B. Inspection For Substantial Completion

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1. Contact construction project representative 48 hours in advance to schedule inspection.
2. Items deemed not acceptable by construction project representative shall be re-worked to the complete satisfaction of the construction project representative.

**3.05 TURF WARRANTY AND MAINTENANCE**

- A. Maintain lawns for a period of 45 days or three cuttings. The grass shall be mowed before it exceeds two inches (2") in height and will be cut to not less than 1-1/4". All lawns shall be fertilized every three (3) weeks with six (6) pounds of 16-16-8 commercial fertilizer per 1,000 square feet until the end of the maintenance period required.
- B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.
- C. The Contractor shall warrant that the turf grasses installed under the work of this section, shall be in a healthy and flourishing condition at Substantial Completion and specified maintenance period for sod.
- D. Sodden turf areas shall exhibit a vibrant green color with no bare spots. Turf grass area(s) shall be free of dead or dying patches associated with disease, and free of weeds, rock or other debris.
- E. The Contractor shall replace any dead or dying materials that are not in a vigorous, thriving condition, weather permitting, upon notification of the Construction Project Representative. The Contractor shall replace material with the same species, variety, color and size as originally installed at no cost to owner. Contractor will not be held responsible to replace any dead or dying turf grass associated with improper maintenance of irrigation system by owner, vandalism or unusual weather phenomena after maintenance period.

**END OF SECTION 02913**

**SECTION 02950**  
**PLANT MATERIAL**

**PART 1 – GENERAL**

**1.01 SCOPE OF WORK**

- A. Work as evident on drawings and specified herein or required to complete all landscaping and shall include, but not necessarily limited to the following work.
  - 1. Furnish and place topsoil from outside sources where necessary.
  - 2. Excavate tree pits.
  - 3. Provide and plant all materials indicated on plan and plant list.
  - 4. Stake and protect all trees and planted areas as needed.
  - 5. Maintain all plant material until maintenance responsibility is transferred to the Owner upon Acceptance of the Work.
  - 6. Clean up all areas prior to Acceptance of the Work, including debris, stains, and dirt from walks and beds.
- B. These specifications are complimentary to the drawings.
- C. Related Sections:
  - 02810 - Irrigation System
  - 02913 - Turf Sod and Soil Preparation

**1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements
  - 1. Comply with applicable requirements of Federal, State and Local laws, regulations and codes having jurisdiction at the project site.
  - 2. Contractor shall be responsible for certificates of inspection of plant material that may be required by Federal and Local authorities to accompany shipments of plants.
- B. Reference Standards

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1. "Standardized Plant Name" by the American Joint Committee of Horticultural Nomenclature.
2. "American Standard of Nursery Stock" by the American Association of Nurseryman.
3. American National Standards Institute (ANSI); Publication Z60.1.

C. Substitutions

1. Substitutions of plant material will not be permitted unless authorized in writing by the Landscape Architect. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract Price. Such proof shall be substantiated and submitted in writing to the Landscape Architect at least thirty (30) days prior to start of the work under this Section. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

D. Source Quality Control

1. Plants shall be subject to inspection and approval by the Landscape Architect at place of growth and upon delivery for conformity to specifications. Such approvals shall not impair the right of inspection and rejection during progress of the Work. Submit written request for inspection of plant material at place of growth and quantity of plants to be inspected. The Landscape Architect reserves the right to refuse inspection at this time if, in his judgement, a sufficient quantity of plants is not available for inspection.
2. All plants inspected at the nursery by the Landscape Architect shall be tagged with self-locking tags. Plants delivered to the site without these tags or with broken tags shall be sufficient reason for rejection.

E. Contractor's Qualifications

1. All bidders shall be required to present proof of their qualifications, experience, and ability to perform the work set forth in these specifications.

**1.03 PROJECT PERSONNEL**

The Contractor shall have a competent foreman in direct and personal charge of the work, and the foreman shall be on the job at least seventy-five (75) percent of the working hours. The Landscape Architect may "shut down" the work under contract if the supervision is not, in his opinion, adequate to protect the interests of the Owner. Such

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“shut down” time to be counted as working days and will not extend the time of the contract.

**1.04 PACKAGING, DELIVERY, STORAGE AND HANDLING**

- A. Plants shall be properly marked for identification and for checking. Each block of plants and at least 25% of each variety of separate plants in any one shipment shall have legible labels securely attached upon delivery to the site.
- B. Each shipment shall be certified by state and federal authorities to be free from disease and infestation. Any inspection certificates required by law to this effect shall accompany each shipment, invoice, order, or stock. On arrival, the certificate shall be filed with the Landscape Architect.
- C. Product Handling
  - 1. During hot weather and when practical, the contractor may be required to transport plant materials between sunset and sunrise if transported in an open trailer or unrefrigerated box.
  - 2. Dug material should be maintained and watered as required at the nursery to guarantee their vitality and health until shipping.
  - 3. Protect all trunks, stems, branches, and root balls during tree tying, wrapping and loading operations from damage.
  - 4. Load balls or containers onto transport vehicle and secure in a manner that protects the structural integrity of the root balls.
  - 5. The contractor shall be solely responsible for the safe transportation of plants to the site and their condition upon arrival. Trees damaged, dehydrated or abused during transit or storage will be rejected.
  - 6. Plant materials shall not be stored on concrete or asphalt or left exposed to the sun.
- D. Roots and balls of plants shall be adequately protected at all times from the sun and drying winds. In normal and winter plantings, ball and burlap plants that cannot be planted within 24 hours of delivery shall be heeled in a bed of bark mulch, or other approved material.
- E. The Landscape Architect may inspect any phase of this operation and may reject any plant material improperly handled during any phase of this operation.

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- F. Nothing in this Section shall be interpreted as relieving the contractor of the responsibility of providing healthy, viable plants, nor shall it have any effect upon the terms of the warranty specified herein.
- G. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.

**1.05 PROTECTION OF EXISTING PLANTS TO REMAIN**

- A. Do not store materials or equipment, permit burning, or operate or park equipment under branches of any existing plant material to remain except as actually required for construction in those areas.
- B. Provide barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.
- C. Notify the Landscape Architect in any case where the Contractor feels grading or other construction called for by Contract Documents may damage existing plants to remain.
- D. If existing plants to remain are damaged during construction, Contractor shall replace such plants of the same species and size as those damaged at no cost to the Owner. Determination of the extent of damage and value of damaged plant shall rest solely with the Landscape Architect.

**1.06 SUBMITTALS**

- A. Furnish three (3) copies of manufacturers literature, samples, certifications, or laboratory analytical data for approval by the Landscape Architect prior to commencement of all work under this contract for the following items:
  - 1. Mulch (sample)
  - 2. Tree and shrub planting fertilizer (certification)
  - 3. Pre-emergent and anti-desiccant (certification)
  - 4. Peat moss (sample and certification)
  - 5. Tree guys (literature)
- B. Submit proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Once accepted, revise dates only as approved in writing, after documentation of reasons for delay.

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- C. Submit typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

**1.07 PROJECT WARRANTY**

- A. Warranty trees and other plant materials, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Installer's control.
- B. Remove and replace trees or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees or other plants that are in doubtful condition at end of warranty period; unless, in opinion of Architect, it is advisable to extend warranty period for a full growing season.
- C. All replacements shall be plants of the same kind, size, and quality as originally specified and they shall be furnished, planted, guyed and maintained as specified at no additional cost.
- D. Another inspection will be conducted at end of extended warranty period to determine acceptance or rejection. Only one replacement (per tree or plant) will be required at end of warranty period, except for losses or replacements due to failure to comply with specified requirements.

**PART 2 – PRODUCTS**

**2.01 TOPSOIL**

- A. Topsoil will be provided by the Contractor. The intent is for the Contractor to use stockpiled on-site topsoil or imported topsoil if on-site topsoil does not meet topsoil quality guidelines. Contractor will be responsible for placement and amendment to topsoil and planting soils. Contractor shall have agronomy soils test performed on any proposed imported soil. Test results shall be submitted to Landscape Architect for approval.
- B. Contractor shall bid the project with the following topsoil quality guidelines as outlined below. Should test results of on site topsoil not meet the specified guidelines, the contractor may amend the on-site topsoil or import new topsoil.
- C. Topsoil shall be used for all new turf areas and as part of the backfill mix for all container planting.

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- D. Topsoil shall consist of friable soil of loam character. It shall be obtained from well-drained arable land and shall be free from sub-soil, refuse, roots, heavy or stiff clay, stones 1 inch and larger, in largest dimension, coarse sand, sticks, brush, litter, and other deleterious substances.

Requirements for topsoil shall be as follows:

TOPSOIL QUALITY GUIDELINES

Category	pH	Soluble Salts dS/m or mmho/cm	Sodium Absorption Ratio (SAR)	Organic Matter %	Sand %	Silt %	Clay %
Ideal	5.5–7.5	<2	<3	≥2.0	<70	<70	<30
Acceptable	5.0-8.2	<4	3 to 10	≥ 1.0	<70	<70	<30
Unacceptable	<5.0 >8.2	>4	>10	<1.0	>70	>70	>30

**2.02 PLANT MATERIALS**

- A. Plants shall be typical of their species and variety, have normal growth habits, well developed branches, dense foliage, vigorous, fibrous root systems.
- B. Plants shall be free from defects and injuries. A Certificate of Inspection by the State Entomologist’s Office of the State Department of Agriculture shall accompany each shipment or delivery of plant stock. All shipments of plant stock shall comply with existing State and Federal laws and regulations governing plant disease and infection and interstate movement of nursery stock.
- C. Quality and size of plants, spread of roots, and size of balls shall be in accordance with USA-Z60.1-1973, “American Standard for Nursery Stock” as published by the American Association of Nurserymen. The caliper of trees shall be measured six (6) inches above the surface of the ground. Plant lists indicate minimum size requirements only. Plant materials shall be equal to or greater in size than those specified.
- D. Plants shall not be pruned before planting.

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- E. All trees must have straight trunks with single leader intact. Bark shall be free of abrasion, all cuts over 1-1/4" shall have callused over.
- F. Trees shall not be accepted which have had their leaders cut or which have leaders damaged so that cutting is necessary.
- G. Trees and shrubs shall be true to name.
- H. Upon request, Contractor shall furnish the Landscape Architect a list indicating the source of each of the different plants to be supplied.
- I. All Plants shall be ball and burlap or container grown unless otherwise indicated on the Plant Material List.
- J. All plants shall be symmetrical in growth with balanced root and top growth and shall be No.1 in grade or type conforming to the latest edition of American Standard for Nursery Stock.
- K. Plant material shall be nursery grown and shall have received the proper fertilizing, watering, root pruning and such other care as is normally given for a particular plant under nursery conditions. All plants shall be hardy under climate conditions similar to those in the locality of the project.
- L. All material shall be freshly dug according to American Standard for Nursery Stock. All ball and burlap material shall be of firm earth from the original soil in which the plant grew. The ball shall be wrapped with burlap and tightly tied or enclosed in a tight fitting wire basket to hold it firm and intact. Any plants with broken or loose balls or manufactured balls will be rejected.
- M. All plant material in cans shall have been established in that can. Any newly potted material will be rejected.

**2.03 FERTILIZER FOR PLANT MATERIAL**

- A. Fertilize the trees and shrubs with a fertilizer table having a slow release nitrogen, phosphorus and potash (20-10-5) plus sulphur and iron formulation. Use two tablets per shrub and three tablets per tree. Tablets manufactured by Agriform or equal. Jobe Tree Spikes are acceptable.
- B. Other "dry" fertilizing methods may be approved by the Landscape Architect.
- C. Any fertilizer that becomes caked or otherwise damaged, making it unsuitable for use will not be accepted.

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**2.04 MULCH**

Organic mulch shall be bagged or bulk shavings of wood such as pine or cedar and free from deleterious material.

**2.05 PRE-EMERGENT**

Pre-Emergent weed killer shall be granulated and shall be "Treflan" or "Dacthal", or approved 12 month weed preventer. See caution in application of pre-emergent weed killer in execution section of this specification

**2.06 ANTI-DESICCANT**

Anti-desiccant shall be an emulsion that will provide a film over plant surfaces permeable enough to permit transpiration, and will not damage the plant, such as "Wilt Pruf" or approved equal. Three applications on all broadleaved evergreens sensitive to moisture evaporation.

**2.07 PEAT HUMUS**

FS Q-P-166 decomposed peat with pH range suitable for intended use.

**PART 3 – EXECUTION**

**3.01 GENERAL**

- A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
- B. Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion. Actual planting shall be performed only when weather and soil conditions are suitable and in accordance with locally accepted practice and as approved by the Landscape Architect.
- C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- D. The location of all plant material shall be staked out by the Contractor for approval by the Landscape Architect prior to installation of the plant material.

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- E. If underground construction, obstructions, or large rocks are encountered in excavation of planting areas, other locations for the planting may be selected by the Landscape Architect.
- F. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on drawings. All planting indicated on drawings is required unless indicated otherwise.
- G. Before commencing the work the Contractor shall review all pipes, wires, conduits, poles or other structures within or adjacent to the right-of-way of the work which may affect his operations.
  - 1. The existence and location of all underground and above ground utilities shall be investigated and verified in the field before starting any work. The Contractor is responsible for all damage to these utilities.
  - 2. Excavation in the vicinity of existing utilities and structures shall be carefully done by hand.

**3.02 PREPARATION OF PLANTING BEDS**

- A. Loosen subgrade of planting bed areas that have had existing topsoil removed, to a minimum depth of 12" using a cultimulcher or similar equipment. Remove stones over 1-1/2" in any dimension, and sticks, stones, rubbish and other extraneous matter.
- B. The Contractor shall furnish and spread topsoil on planting bed areas as required to meet lines, grades and elevations shown, after light rolling and natural settlement. Finish grade of all planting bed areas shall be 1-1/2" below grade of adjacent pavement of any kind.
- C. Fine grade planting bed areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag planting bed areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
- D. Beds shall be raked smooth and put in first class condition before final acceptance.

**3.03 EXCAVATION FOR PLANTING**

- A. Obstruction Below Ground: Do not plant any plant with a large obstruction directly below the root ball. In the event that rock or obstructions are encountered in any plant pit excavation, alternate locations shall be selected by the Landscape Architect.
- B. Drainage: In the event that impervious rock or hardpan is encountered during digging operations, in tree pits or shrub pits, it shall be the responsibility of the

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Landscape Contractor to insure proper drainage in all pits. Minimum drainage requirements shall be the loss of water at the rate of 6" drop in water level per hour. All rock or hardpan encountered shall be disposed of from the site.

- C. Holes for trees and shrubs shall be three times (3x) the ball diameter for trees and two times (2x) the ball diameter for shrubs as per planting details. All subsoil excavated from tree and shrub pits shall be removed from the site.
- D. Tree and shrub pits in lawn areas shall be circular in outline, with a diameter at least two (2) feet greater than the diameter of the ball of each plant to be planted.
- E. Where existing turf areas are damaged by planting operations, they shall be replaced by equal quality turf by the Landscape Contractor at no cost to the Owner.
- F. Clear areas designated as planting beds.
- G. Remove trees and shrubs indicated. Remove stumps, main root ball, and root system to a depth as required for the proper installation of the specified replacement plant material.
- H. Treat all remaining vegetation in planting bed areas with weed killer to prevent further growth.
- I. Remove debris, rock, and extracted plant life from the site.

### 3.04 SETTING AND BACKFILLING PLANTS

- A. Placing Plants: Plants shall be set with the root ball at the same natural relationship as it had in the nursery. The top of the root ball should be level or slightly above the finished grade. Plants shall be handled by the root ball, not by the trunk or by the stems. Balls must be handled carefully and the trees must be skidded (not dropped) into the hole.
- B. Soil used for backfilling all plants shall consist of four parts of topsoil thoroughly mixed with one part sphagnum peat moss. Backfill shall be worked around the ball and tamped to eliminate air pockets. The plants will be watered when the hole is two-thirds (2/3) full of backfill.
- C. At this point, any wire, twine, burlap, etc., tied or wrapped around the stem or plant ball shall be loosened and pulled away from the plant. The burlap on the ball shall be laid back from the top of the ball and any excess burlap and ties shall be cutoff and removed from the planting well.
- D. Soil treatment: A pre-emergent herbicide such as "Dacthal" or "Treflan", or an approved equal shall be delivered to the site in its original container, bearing the

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manufacturer's label and instructions for handling and application. All trees and shrubs are to receive pre-emergent.

- E. All plants shall be watered and straightened the same day as planted. No holes will be left open over night.
- F. Container grown plants shall have containers cut open and the plants carefully removed so that the earth around roots of plant remain unbroken. Plants shall then be planted in the same manner as ball plants.
- G. Plant trees after final grades are established and prior to planting of lawns, unless otherwise acceptable to Landscape Architect. If planting of trees occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- H. All plant material must be watered the same day it is planted in order to comply with these specifications. Any plant not watered at the time of planting will be rejected at the option of the Landscape Architect.
- I. The Contractor shall hand water newly planted trees twice a week for eight weeks with a minimum of five (5) gallons per tree per watering.
- J. All plant material shall be staked and guyed as shown on detail. The stakes will be driven into the hole after the tree has been set-in, but before backfilling begins so as to avoid damage to the roots. Any deviation will not be accepted.

**3.05 PRUNING**

- A. Subject to approval by the Owner, pruning shall not be done before plants are firmly in place.
- B. In general, all trees are to be pruned to correct structural deficiencies; to remove dead or broken limbs, double or multiple leaders; and to shape the plant in a manner consistent with the species. Additional pruning may be required at the option of the Landscape Architect. All bruises, debarking, and cut limbs are to be cleaned and painted with tree wound dressing.

**3.06 APPLICATION OF MULCH**

Unless otherwise specified, all planting beds are to be mulched with an approved shredded bark mulch. Mulch shall be uniformly applied to a depth of 2 inches, unless specified otherwise on plans or details, and shall not smother the plants. Any large pieces of wood, nails, or other debris shall be removed from the mulch.

**3.07 PROTECTION AND CLEAN-UP**

PLANT MATERIAL

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- A. The Contractor shall remove at the end of each day rock, excess subsoil, and other waste material. All planting sites shall be left in a condition acceptable to the Landscape Architect. If any remedial action is necessary by the Landscape Architect, the cost of such action (\$50.00 minimum) shall be withheld from payment due the Contractor. Delays in clean-up caused by weather conditions are to be reported to the Landscape Architect on the day such delays occur, together with an estimate of when clean-up can be affected.
- B. The Contractor shall repair, to the satisfaction of the Landscape Architect, any damage to the project site he causes. The Contractor shall have full responsibility for the protection, preservation and maintenance of the project site. All property damage will be reported to the Landscape Architect, accompanied by a signed release obtained from the property owner. This shall be done prior to payment for completed work.

**3.08 MAINTENANCE**

- A. Begin maintenance immediately after planting.
- B. Maintain trees and other plants until substantial completion of project.
- C. Maintain trees and other plants by pruning, cultivating and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees free of insects and disease.

**3.09 INSPECTION AND ACCEPTANCE**

- A. When landscape work is completed, including maintenance, Landscape Architect will, upon request, make an inspection to determine acceptability.
- B. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from the project site.

**END OF SECTION 02950**

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**SECTION 02952**

**SEEDING OF NATIVE GRASS AND WILDFLOWERS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

A. Related Sections:

02810 - Irrigation System  
02950 – Plant Material

B. The Work under this Section shall consist of furnishing all labor, materials and incidentals needed to install topsoil and turf grass in accordance with these Specifications.

**1.02 QUALITY ASSURANCE**

A. Inspection certificates required by state law shall accompany each shipment and be delivered to the Construction Project Representative.

B. Personnel: Employ only qualified personnel familiar with required work.

**1.03 SUBMITTALS**

A. Product Data: The Contractor shall submit as part of the project submittal package, three (3) complete sets of the supplier's guaranteed statement of:

1. Composition, mixture, percentage of purity and germination for variety of seed, specified herein for approval by the construction project representative.

**PART 2 - PRODUCTS**

**2.01 SEED**

A. Seed Mixture: See planting plan for seed mixture and varieties.

1. Grass seed shall be fresh, clean and new crop seed composed of the following varieties mixed in the specified proportions by weight, as shown and tested to a minimum of 95% purity and 85-90% germination. The grass seed shall be applied at a minimum rate of twenty-five (25) pounds per acre and the wildflower blend at a rate of thirty (30) pounds per acre.

**2.02 HYDO-SEEDING MULCH**

A. Mulch material shall be "Silva-fiber" as manufactured by Weyerhaeuser Company,  
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Silva Products and applied at the rate of 1400 pounds per acre.

### **2.03 FERTILIZER**

- A. Fertilizer shall be a complete mixture, analyzing sixteen (16)% Nitrogen; sixteen (16)% Phosphoric Acid; and sixteen (16)% Pot Ash, of commercial type and applied at a rate of one (1) pound per thousand (1000) square feet of area.

## **PART 3 – EXECUTION**

### **3.01 GRADE PREPARATION**

- A. When contract operations have been completed to a point where the areas will not be disturbed, subgrade shall be cleaned of waste material of all kinds, scarified and pulverized to a depth of not less than 4 inches, removing surface inequalities.

### **3.02 SEED BED PREPARATION**

- A. Seed mixture shall be planted in all areas labeled on drawings and if necessary beyond the contract limit line where damaged during the construction of the project. The contractor shall be sure that all areas will blend into the existing grade with a natural finished grade.
- B. The contractor shall prepare only enough ground that can be seeded within twenty-four hours thereafter.
- C. No seeding shall be done when wind velocities exceed five miles per hour, or immediately after a rain, if the prepared surface has been compacted. If compacted, loosen the surface to a smooth, loose, uniform fine texture as previously specified.

### **3.03 SEEDING METHODS**

- A. Seeding shall be applied by broadcasting and raked into 1/4" of the top layer of soil or drill seeded. Hydro-mulch shall be sprayed over the prepared seeded areas. The hydro-mulch shall consist of fertilizer at the rate of eight pounds per one thousand square feet and "Fiber mulch" at the rate of fourteen hundred pounds per acre of area. With water, agitate these components into a well-mixed slurry substance and spray the mixture under pressure onto the prepared areas.

### **3.04 TIME OF SEEDING**

- A. Where irrigation is not used, seeding shall occur only during the following seasons:

1. Spring Seeding: Spring thaw to May 1<sup>st</sup>.

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2. Fall Seeding: September 15<sup>th</sup> until consistent ground freeze.

**3.05 WATERING OF SEEDED AREAS**

- A. The contractor shall be totally responsible for all initial watering of newly seeded areas.
- B. The entire area upon seeding completion shall be soaked with a fine spray.
- C. Care shall be taken to avoid excessive washing to puddling on the surface. Such damage will be repaired at the contractor's expense.

**3.06 WARRANTY AND MAINTENANCE**

- A. The contractor shall be responsible for attaining germination of the seeded area until the entire area is accepted by the owner. The inspection of seeded areas can be independent of the projects final inspection.

**3.07 CLEAN-UP**

- A. The Contractor shall remove weekly or as sufficient amounts accumulate, all unused material, or waste material from the premises. The site shall be left in a clean and orderly condition to the satisfaction of the inspector.

**END OF SECTION 02952**

**SECTION 16001 –**

**ELECTRICAL GENERAL PROVISIONS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Civil, Landscape and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of electrical work is indicated on drawings and/or specified in Division 16 sections of the specifications. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system.
- B. Use standard industry symbols together with the special symbols, notes and instructions indicated on the drawings. Describe the work, materials, apparatus and systems required as a portion of this work.
- C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

**1.03 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:**

- A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose and function of the contract documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

**1.04 QUALITY ASSURANCE:**

- A. Comply with requirements of State and Local ordinances. If a conflict occurs between these requirements and the contract documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the contract documents which may be in

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excess of the aforementioned requirements, and not contrary to same.

- B. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.
- C. Contractor shall have a current State Contracting License applicable to type of work to be performed under this contract.

**1.05 RECORD DRAWINGS:**

See Supplemental Conditions.

- A. **GUARANTEE:** Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications and/or authorized changes. Without additional charge, replace any work or materials which develop defect, except for ordinary wear and tear, within one year from the date of substantial completion.
- B. **GENERAL:** Products are specified by manufacturer name, description and/or catalog number.
- C. Discrepancies between equipment specified and the intended function of the equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding.

**PART 2 - EXECUTION**

**2.01 INSTALLATION:**

- A. Lay out electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting of work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.
- B. Since the drawings of floor, wall and ceiling installation are made at small scale; outlets devices equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.
- C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult architectural and mechanical and all

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applicable shop drawings to avoid switch, outlets and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

**2.02 CLEAN-UP:**

- A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.
- B. Clean fixtures, interiors and exteriors of all equipments, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

**2.03 STORAGE AND PROTECTION OF MATERIALS:**

- A. Provide storage space for storage of materials and apparatus, and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare, or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

**2.03 EXCAVATING FOR ELECTRICAL WORK:**

- A. Complete all excavation per provisions of Division 2.

**2.04 CONCRETE BASES:**

- A. Concrete bases shall be provided under Division 16. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves and templates as required to obtain a proper installation.

**2.05 FIRE PENETRATION SEALS:**

- A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code.
- B. Where applicable, provide OZ type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, type PSS7904, and/or Thomas & Betts Flame Safe Fire Stop system, including wall wrap, partitions, caps and other accessories as required.

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- C. Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

**2.06 PROJECT FINALIZATION AND START-UP:**

- A. **FINAL REVIEW:** At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

**END OF SECTION 16001**

**SECTION 16110**

**RACEWAYS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 section making reference to electrical raceways specified herein.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of raceways is indicated in drawings and schedules.
- B. Types of raceways in this section include the following:
  - 1. Electrical Metallic Tubing
  - 2. Flexible Metal Conduit
  - 3. Intermediate Metal Conduit
  - 4. Liquid-Tight Flexible Metal Conduit
  - 5. Rigid Metal Conduit
  - 6. Rigid Non-metallic Conduit

**1.03 DUALITY ASSURANCE:**

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- C. UL Compliance: Comply with provisions of UL safety standards pertaining to electrical raceway systems, and provide products and components which have been UL listed and labeled.
- D. NEC Compliance: Comply with requirements as applicable to construction and installation of raceway systems.

**1.03 SUBMITTALS:**

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- A. None required.

**PART 2 - PRODUCTS**

**2.01 METAL CONDUIT AND TUBING:**

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated. Minimum size 3/4".
- B. Rigid Steel Conduit: FS WW-C-0581 and ANSI C80.1.
- C. Intermediate Steel Conduit FS-WW-C-581
- D. Rigid Metal Conduit Fittings: FS W-F-408:
1. Use type 1 fittings for rain tight connections
  2. Use type 2 fittings for concrete tight connections
  3. Use type 3 fittings for other miscellaneous connections
- Use OZ type bushings on conduits 1 1/4" and larger
- E. Electrical Metallic Tubing (EMT): ANSI C80.3 and NEMA. Standard Publication No. RN 1.
- F. EMT Fittings: Provide insulated throat non-indenter type malleable steel fittings; concrete tight where required by application. Install OZ type B bushings on conduits 1 1/4" and larger.
- G. Flexible Metal Conduit: FS WW-C-566, of the following type:
1. Zinc-Coated Steel
  2. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1 and Style A.
- H. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked and double-wrapped steel; galvanize inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- I. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G.

**2.02 NON-METALLIC CONDUIT AND DUCTS:**

- A. General: Provide non-metallic conduit, ducts and fittings of types, sizes and

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weights (wall thickness) for each service indicated.

- B. PVC Conduit And Tubing Fittings: NEMA Standards published No. TC 3, match to conduit/tubing type and material.
- C. PVC Accessories: Provide conduit, tubing and duct accessories of types, sizes and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF ELECTRICAL RACEWAYS:**

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices and in accordance with the following:
  - 1. Branch Circuits, Signal and Control Circuits, and Individual Equipment Circuits Rated Less Than 100 Amps: Install in electric metallic tubing (EMT) in dry areas. Install in non-metallic plastic duct. in poured walls, below concrete slab-on-grade, or in earth fill.
  - 2. Conduit Installation Below Slab-On-Grade, or Below Grade: For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. Install GRC (with protective coating) for elbows passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
  - 3. Apply protective coating to metallic raceways in direct contact with earth or fill of any type: consisting of spirally wrapped PVC tape (1/2" minimum overlap of Scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .02"). Completely wrap and tape all field joints.
  - 4. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
- B. Install GRC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.
- C. Provide a minimum of 12" clearance from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment.

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- D. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
- E. Comply with NEC for requirements for installation of pull boxes in long runs.
- F. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandrill and swab through all conduit before installing conductors. Install a 200 lb. nylon cord in each empty conduit run.
- G. Replace all crushed, wrinkled or deformed raceway before installing conductors.
- H. Provide rigid metal conduit GRC for all bends in buried conduit greater than 30 degrees. Provide protective coating for GRC bend as specified herein.
- I. Where raceways penetrate building or vault walls and floors below grade, install rigid metal conduit (GRC) for a minimum distance of 36" on the exterior side of the floor or wall. Provide OZ, type FSK or WSK sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering building or vaults below grade.
- J. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.
- K. Provide OA cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.
- L. Level and square raceway runs, and install at proper elevations/heights.
- M. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- N. Install liquid-tight flexible conduit for connection of motors and for other electrical equipment where subject to movement and vibration, and also where subjected to one or more of the following conditions:
  - 1. Exterior Location
  - 2. Moist or Humid Atmosphere Where Condensate Can Be Expected To Accumulate
  - 3. Corrosive Atmosphere
  - 4. Subjected to Water Spray

**3.01 ADJUSTING AND CLEANING:**

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- A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

**END OF SECTION 16110**

**SECTION 16120**  
**WIRES AND CABLES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 sections making reference to electrical wired and cables specified herein.

**1.02 DESCRIPTION OF WORK:**

- C. Extent of electrical wire and cable work is indicated in drawings and schedules.
- D. Types of electrical wire, cable and connectors specified in this section include the following:
  - 1. Copper Conductors
  - 2. Fixture Wires
  - 3. Tap Type Connectors
  - 4. Split-Bolt Connectors
  - 5. Wire nut Connectors

**1.03 QUALITY ASSURANCE:**

- E. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- F. NEC Compliance: Comply with NEC requirements as applicable to construction installation and color coding of electrical wires and cables.
- G. UL Compliance: Comply with applicable requirements of UL standard 83, "Thermoplastic Insulated Wires and Cables", and standard 486A, "Wire Connectors and Soldering Lugs for use with Copper Conductors". Provide wiring/cabling and connector products which are UL listed and labeled.
- H. NEMA/ICEA Compliance: Comply with NEMA/ICEA STd. Pub/No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables",

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pertaining to electrical power type wires and cables.

- I. IEEE COMPLIANCE: Comply with applicable requirements of IEEE standard 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and standard 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- J. ASTM Compliance: Comply with applicable requirements of ASTM B1,2,3,8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F).
- K. FS COMPLIANCE: Comply with Federal Specifications J-C-30, "Electrical Cable and Wire, (Power, Fixed, Installation)", and W-S-610, "Splice Conductor".

**1.04 SUBMITTALS:**

None required.

**1.05 DELIVERY, STORAGE AND HANDLING:**

- L. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.
- M. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- N. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS:**

- A. WIRES, CABLES AND CONNECTORS:
  - 1. General: Provide electrical wires, cables and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F).
  - 2. Minimum conductor size shall be #12 (unless noted otherwise.)
  - 3. Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated,

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provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:

- a) Type THWN: For dry and wet locations; maximum operating temperature 75 degrees C (167 degrees F). Insulations, flame-retardant, moisture and heat resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
- b) Type XHHW: For dry and wet locations; maximum operating temperature 90 degrees C (194 degrees F). Insulation, flame-retardant, cross-linked synthetic polymer; conductor, annealed copper.
- c) Control Wiring: For remote sensors in sales area; 3 conductor 18 gauge shielded.

4. Connectors:

- a) General: Provide UL type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

- 1. Type: Pressure
- 2. Type: Crimp
- 3. Type: Threaded
- 4. Class: Insulated

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF WIRES AND CABLES:**

- B. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL and NECA's

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"Standard of Installation", and in accordance with recognized industry practices.

- C. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- D. Install wiring in conduit, with no more than 3 circuits per home run. Specific exceptions are indicated on plans.
- E. Pull conductors simultaneously where more than one is being installed in same raceway.
- F. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- G. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
- H. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.
- I. Keep conductor splices to minimum.
- J. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.
- K. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL standard 486A & B.

**3.02 COLOR CODING:**

120/208

A-Phase - Black  
B-Phase - Red  
C-Phase - Blue  
Neutral - White  
Ground - Green

**3.03 FIELD QUALITY CONTROL:**

**3.03.1** Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are

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fulfilled.

**3.03.2** Prior to energization, test wires and cables for electrical continuity and for short-circuits.

**3.03.3** Subsequent to wire and cable hook-ups energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

**END OF SECTION 16120**

**SECTION 16135**

**ELECTRICAL BOXES AND FITTINGS**

**PART 1 – GENERAL**

**1.02 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical wiring boxes and fittings specified herein.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of electrical box and associated fitting work is indicated in drawings and schedules.
- B. Types of electrical boxes and fittings specified in this section include the following:
  - 1. Outlet Boxes
  - 2. Junction Boxes
  - 3. Pull Boxes
  - 4. Bushings
  - 5. Locknuts
  - 6. Knockout Enclosures

**1.03 QUALITY ASSURANCE:**

- A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of type, sizes and capabilities required, whose products have been in satisfactory use in similar service for not more than 3 years.
- B. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- C. UL Compliance: Comply with applicable requirements of UL 50, UL 514 - Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA standards published No.'s OS1, OS2 and Published 250 pertaining to outlet and device boxes, covers and box supports.

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- E. Federal Specification Compliance: Comply with applicable requirements of FS W-C-586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies and Entrance Caps".

**1.04 SUBMITTALS:**

None required.

**PART 2 - PRODUCTS**

**2.01 FABRICATED MATERIALS:**

- A. Outlet Boxes: Provide galvanized coated flat rolled sheet steel outlet wiring boxes, of shapes, cubic inch capacities and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
- B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- C. Rain Tight Outlet Boxes: Provide corrosion resistant cast metal rain tight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast metal face plates with spring hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion resistant plugs and fasteners.
- D. Junction And Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- E. Bushings, knockout closures and locknuts: Provide corrosion resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS**

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- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather tight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations to ensure ready accessibility to enclosed electrical wiring.
- F. Avoid installing boxes back-to-back in walls. Provide not less than 6" (150 mm) separation.
- G. Position recessed outlet boxes accurately to allow for surface finish thickness.
- H. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- I. Provide electrical connections for installed boxes.
- J. Subsequent to installation of boxes, protect boxes from construction debris and damage.

**3.02 ROUNDING:**

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance.

**END OF SECTION 16135**

**SECTION 16142**

**ELECTRICAL CONNECTIONS FOR EQUIPMENT**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 sections making reference to electrical connections for equipment specified herein.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of electrical connections for equipment includes final electrical connection of all equipment having electrical requirements, including owner-furnished equipment.
- B. Electrical identification for wires/cables conductors is specified in Division 16 section, "Electrical Identification", and is work of this section.
- C. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this section.
- D. Refer to sections of other Divisions for specific individual equipment power requirements.

**1.03 QUALITY ASSURANCE:**

- A. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters and disconnect switches.
- B. IEEE Compliance: Comply with standard 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
- C. ANSI Compliance: Comply with applicable requirements of ANSI/NEA standards

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pertaining to products and installation of electrical connections for equipment.

- D. ULL Compliance: Comply with ULL standard 486A, "Wire Connectors and Soldering Lugs For Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are ULL listed and labeled.

**1.04 SUBMITTALS:**

None required.

**PART 2 - PRODUCTS**

**2.01 MATERIALS AND COMPONENTS:**

- 2 GENERAL: For each electrical connection indicated, provide complete assembly of materials, including, but not necessarily limited to, pressure connectors terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat shrinkable insulating tubing, cable ties, soleless wire nuts, and other items and accessories as needed to complete splices and terminations of types indicated. See other Division 16 sections, "Raceways", "Wiring Devices" and "Wire and Cable" for additional requirements.

**PART 3 - EXECUTION**

**3.01 INSPECTION:**

- A. Inspect areas and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

**3.02 INSTALLATION OF ELECTRICAL CONNECTIONS:**

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of ULL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance

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with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

- D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- E. Prepare cables and wires, by cutting and stripping covering armor, jacket and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
- H. Provide liquid tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration.

**3.03 FIELD QUALITY CONTROL:**

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

**END OF SECTION 16142**

**SECTION 16190**

**SUPPORTING DEVICES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 section making reference to supports, anchors, sleeves and seals specified herein.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of supports, anchors, sleeves and seals is indicated in drawings and schedules and/or specified in other Division 16 sections.
- B. Types of supports, anchors, sleeves and seals specified in this section include the following:
  - 1. Clevis Hangers
  - 2. Riser Clamps
  - 3. C-Clamps
  - 4. I-Beam Clamps
  - 5. One Hole Conduit Straps
  - 6. Two Hole Conduit Straps
  - 7. Round Steel Rods
  - 8. Lead Expansion anchors
  - 9. Toggle Bolts
  - 10. Wall and Floor Seals
- C. Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 16 sections.

**1.03 QUALITY ASSURANCE:**

- A. **MANUFACTURERS:** Firms regularly engaged in manufacture of supporting devices, of types, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. **INSTALLER:** Qualified with at least 3 years of successful installation experience on projects with electrical installation work similar to that required

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for this project.

- C. NEC COMPLIANCE: Comply with NEC as applicable to construction and installation of electrical supporting devices.
- D. ANSI/NEMA COMPLIANCE: Comply with applicable requirements of ANSI/NEMA Standards Published No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies".
- E. NECA COMPLIANCE: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports and equipment mounting.
- F. UL COMPLIANCE: Provide electrical components which are UL listed and labeled.
- G. FS COMPLIANCE: Comply with Federal Specification's FF-S-760 pertaining to retaining strap for conduit, pipe and cable.

**1.04 SUBMITTALS:**

None required.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURED SUPPORTING DEVICES:**

- A. GENERAL: Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified.
- B. SLEEVES AND SEALS: Provide sleeves and seals, of types, sizes and materials indicated; and having the following construction features:
- C. WALL AND FLOOR SEALS: Provide factory-assembled water tight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe or tubing passing through concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps and cap screws.
- D. CONDUIT CABLE SUPPORTS: Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2" rigid metal conduit; 3 wires, type wire as indicated; construct body of malleable iron casting with hot-dip galvanized finish.

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- E. U-CHANNEL STRUT SYSTEM: Provide U-channel strut system for supporting electrical equipment, 16 ga. hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:
- F. Fixture Hangers
  - G. Channel Hangers
  - H. End Caps
  - I. Beam Clamps
  - J. Wiring Stud
  - K. Thinwall Conduit Clamps
  - L. Rigid Conduit Clamps
  - M. Conduit Hangers
  - N. U-Bolts

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF SUPPORTING DEVICES:**

- A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices.
- C. Install hangers, supports, clamps and attachments to support conduit properly from building structure.
- D. RACEWAYS: Support raceways which are rigidly attached to structure at intervals not to exceed 8 feet o.c. and within 12" of each junction box, outlet or fitting.
- E. FLOOR MOUNTED EQUIPMENT: Provide rigid attachment of all floor mounted equipment furnished under Division 16 to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" o.c. along entire perimeter of the equipment.
- F. Tighten sleeve seal nuts until sealing grommets have expanded to form water tight seal.
- G. SEISMIC BRACING: Provide calculations by a registered structural engineer for seismic bracing required for electrical equipment.

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**END OF SECTION 16190**

**SECTION 16195**

**ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 section making reference to electrical identification specified herein.

**1.02 DESCRIPTION OF WORK:**

- A. Types of electrical identification work specified in this section include the following:
  - 1. Buried Cable Warnings
  - 2. Electrical Power, Control and Communication Conductors Operational Instructions and Warnings
  - 3. Danger Signs
  - 4. Equipment/System Identification Signs
- B. Refer to Division 1 general requirements section, "Identification Systems", for equipment and system nameplates, and performance data; not work of this section.

**1.03 QUALITY ASSURANCE:**

- A. **NEC COMPLIANCE:** Comply with NEC as applicable to installation identifying labels and markers for wiring and equipment.
- B. **NEMA COMPLIANCE:** Comply with applicable requirements of NEMA Standard No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

**1.04 SUBMITTALS:**

None required.

**PART 2 - PRODUCTS**

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- A. GENERAL: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

**2.01 COLOR-CODED PLASTIC TAPE:**

- A. GENERAL: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick and 1 1/2" wide.

**2.02 UNDERGROUND-TYPE PLASTIC LINE MARKER:**

- A. GENERAL: Manufacturer's standard permanent, bright-colored, continuous printed plastic tape, intended for direct burial service; not less than 6" wide and 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

**2.02 BAKED ENAMEL DANGER SIGNS:**

- A. GENERAL: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 ga. steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, BURIED CABLE.

**2.03 ENGRAVED PLASTIC-LAMINATE SIGNS:**

- A. GENERAL: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in size and thickness indicated. engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
  - 1. THICKNESS: 1/16", except as otherwise indicated.
  - 2. FASTENERS: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

**2.04 LETTERING AND GRAPHICS:**

- A. GENERAL: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and

### **PART 3 - EXECUTION**

#### **3.01 APPLICATION AND INSTALLATION:**

- A. GENERAL INSTALLATION REQUIREMENTS: Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
- B. COORDINATION: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
- C. REGULATIONS: Comply with governing regulations and requests of governing authorities for identification of electrical work.

#### **3.02 UNDERGROUND CABLE IDENTIFICATION:**

- A. GENERAL: During back-filling/top-soiling of each exterior underground electrical, signal or communication cable, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
- B. Install line marker for every buried cable, regardless of whether direct buried or protected in conduit.

#### **1.03 DANGER SIGNS:**

- A. GENERAL: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
- B. HIGH VOLTAGE: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 V.

#### **1.04 EQUIPMENT/SYSTEM IDENTIFICATION:**

- A. GENERAL: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1 1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents & shop drawings. Provide signs for each unit of the following categories of electrical work:

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1. Equipment control switches

- B. Install signs at locations indicated or, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

**END OF SECTION 16195**

**SECTION 16450**

**GROUNDING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Division 16 Basic Electrical Materials and Methods section apply to work of this section.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of grounding work is indicated on drawings and specified herein.
- B. Types of grounding specified in this section include the following:
- C. Solid Grounding
- D. Applications of grounding work in this section include the following:
  - 1. Grounding Electrodes
  - 2. Grounding Rods
  - 3. Enclosures
  - 4. Equipment
- E. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

**1.03 QUALITY ASSURANCE:**

- A. **NEC COMPLIANCE:** Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.
- B. **UL COMPLIANCE:** Comply with applicable requirements of UL Standards No's. 467 and 869 pertaining to electrical grounding and bonding.
- C. **IEEE COMPLIANCE:** Comply with applicable requirements of IEEE Standards No's. 142 and 241 pertaining to electrical grounding.

**1.04 SUBMITTALS:**

None required.

## **PART 2 - PRODUCTS**

### **2.01 GROUNDING SYSTEMS:**

- A. MATERIALS AND COMPONENTS:
- B. GENERAL: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/ wires, connectors, terminals (solderless lugs), grounding rods/electrodes, bonding jumper braid, and additional accessories needed for complete installation. Where materials or components are not indicated, provide products complying with NEC, UL and established industry standards for applications indicated.
- C. Raceways and boxes
- D. General: Provide raceways and electrical boxes and fittings complying with Division 16 Basic Electrical Materials and Methods sections "Raceways" and "Electrical Boxes and Fittings", in accordance with the following listing:
  - 1. Rigid Steel Conduit
  - 2. Electrical Metallic Tubing
  - 3. Flexible Metal Conduit, Type 2
  - 4. Liquid Tight Flexible Metal Conduit
  - 5. Rigid Metal Conduit Fittings
  - 6. EMT Fittings, Type 1
  - 7. Flexible Metal Conduit Fittings
  - 8. Liquid Tight Flexible Metal Conduit Fittings
- E. CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.

### **2.02 GROUND RODS:**

- A. GROUND RODS: Steel with copper welded exterior, 3/4" dia. x 10 feet.
- B. ELECTRICAL GROUNDING CONNECTION ACCESSORIES: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.
- C. FIELD WELDING: Comply with AWS Code for procedures, appearance and

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quality of welds; and methods used in correcting welding work. Provide welding connections where grounding conductors connect to underground grounding rods/ electrodes.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF ELECTRICAL GROUNDING:**

- A. GENERAL: Install electrical grounding systems in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.
- C. BONDING JUMPER BRAID: Copper braided tape, constructed of 30 ga. bare copper wires and properly sized for indicated applications.
- D. BONDING PLATES, CONNECTORS, TERMINALS AND CLAMPS: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by plate, connector, terminal and clamp manufacturers for intended applications.
- E. Weld grounding conductors to underground grounding rods/electrodes.
- F. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- G. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC.

**3.02 FIELD QUALITY CONTROL:**

- A. Upon completion of installation of electrical grounding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 3 ohms, take appropriate action to reduce resistance to 3 ohm, or less, by testing soil encircling ground rod; then retest to demonstrate compliance.

**END OF SECTION 16450**

**SECTION 16475**

**OVERCURRENT PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 section making reference to overcurrent protective devices.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of overcurrent protective device work is indicated in drawings and schedules.
- B. Type of overcurrent protective devices in this section include the following:
  - 1. Molded-Case Circuit Breakers
  - 2. Fuses
- C. Refer to other Division 16 sections for cable/wire and connector work required in conjunction with overcurrent protective devices; not work of this section.

**1.03 QUALITY ASSURANCE:**

- A. **NEC COMPLIANCE:** Comply with NEC requirements as applicable to construction and installation of overcurrent protective devices.
- B. **UL COMPLIANCE:** Comply with applicable requirements of UL. Provide overcurrent protective devices which are UL listed and labeled.
- C. **NEMA COMPLIANCE:** Comply with applicable requirements of NEMA Standard Published No's. AB1, AB2 and SG3 pertaining to molded-case and low-voltage power type circuit breakers.
- D. **ANSI COMPLIANCE:** Comply with applicable requirements of ANSI C97.1 pertaining to low-voltage cartridge fuses.
- E. **FS COMPLIANCE:** Comply with Federal Specification W-C-375B/GEN pertaining to molded-case circuit breakers.

**1.04 SUBMITTALS:**

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- A. **PRODUCT DATA:** Submit manufacturer's data on overcurrent protective devices, including: Amperes, voltages and current ratings, current limitations, internal characteristic curves and mounting requirements.
- B. **SHOP DRAWINGS:** Submit layout drawings of overcurrent protective devices showing spatial relationships of units to associated electrical equipment, and connections to electrical power supplies.
- C. **MAINTENANCE STOCK, FUSES:** For types and ratings required, furnished additional fuses, amounting to one unit for every 5 installed units, but not less than one unit of each.

**PART 2 - PRODUCTS**

**1.02 ACCEPTABLE MANUFACTURERS:**

- A. **MANUFACTURER:** Subject to compliance with requirements, provide products compatible with the existing panelboards:
- B. **CIRCUIT BREAKERS**
- C. Square D Company
- D. **FUSES**
- E. Bussmann Division; McGraw-Edison Company

**1.03 CIRCUIT BREAKERS:**

- A. **GENERAL:** Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components and construction in accordance with published product information, and as required for a complete installation.
- B. **MOLDED-CASE CIRCUIT BREAKERS:** Provide factory-assembled, molded-case circuit breakers of frame size and capacity indicated on drawings. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and fault-current limiting protection, ampere ratings as indicated. Construct with over center, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip button on cover for mechanical tripping circuit breakers. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40 degrees C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

**1.04 FUSES:**

- A. GENERAL: Except as otherwise indicated, provide fuses of types, sizes, ratings and average time/current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials and construction in accordance with published product information, and with industry standards and configurations.
- B. CLASS RK1 CURRENT-LIMITING FUSES: Provide UL Class RK1 current-limiting fuses for protecting non-inductive loads.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:**

- A. Install overcurrent protective devices as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.
- C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports or cabling.
- D. Set field-adjusted circuit breakers for trip settings as indicated, subsequent to installation of units.

**3.02 ADJUST AND CLEAN:**

- A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

**B. FIELD QUALITY CONTROL:**

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

**END OF SECTION 16475**

**SECTION 16551**

**ROADWAY AND PARKING AREA LIGHTING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Division 16 Basic Materials and Methods sections apply to work of this section.

**1.02 DESCRIPTION OF WORK:**

- A. Extent of roadway and parking area lighting work is indicated on drawings and schedules.
- B. Excavation and backfilling for roadway and parking area lighting poles, standards and foundations are to be installed per Division 2 general provisions section.
- C. Refer to Division 3 sections for description of concrete work required in connection with lighting poles and standards.
- D. Wires/cables, raceways and electrical boxes and fittings are specified in Division 16 Basic Materials and Methods sections, "Wires and Cables", "Raceways" and "Electrical Boxes and Fittings".

**1.03 QUALITY ASSURANCE:**

- A. **NEC COMPLIANCE:** Comply with NEC as applicable to location and installation of lighting poles and standards.
- B. **UL COMPLIANCE:** Provide lighting components and fittings which are UL listed and labeled.
- C. **ANSI COMPLIANCE:** Comply with applicable requirements of ANSI C2, "National Electrical Safety Code", pertaining to construction and installation of poles and standards.
- D. **NEMA COMPLIANCE:** Comply with NEMA standards pertaining to roadway and parking area lighting units.

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**1.04 SUBMITTALS:**

- A. **PRODUCT DATA:** Submit manufacturer's data on roadway and parking area lighting units including, but not limited to, fabricated poles and standards, mast arms, luminaires, brackets and lamps.

**1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Handle metal lighting standards and brackets carefully to prevent breakage, denting and scoring finish.
- B. Deliver lighting fixtures and fittings wrapped in factory-fabricated fiberboard type containers.
- C. Store lighting fixtures and fittings in original cartons and protect from construction traffic and debris.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS:**

- A. **MANUFACTURER:** Subject to compliance with requirements, provide roadway and parking area lighting units as scheduled in Lighting Fixture Schedule.

**2.02 MATERIALS AND COMPONENTS:**

- A. **GENERAL:** Provide roadway and parking area lighting units of sizes, types and ratings indicated, complete with, but not limited to, poles/standards, brackets, mast arms, luminaires and other components and accessories required for complete roadway and parking area lighting systems.

**2.03 LIGHTING STANDARDS AND POLES**

- A. **METAL LIGHTING STANDARDS:** Provide metal, raceway-type, lighting poles and standards, of sizes and types indicated, comprised of shafts and tenon joints. Equip with grounding connections readily accessible from handhole access doors:
- B. **CONFIGURATION:** Anchor base type with handhole and bolt covers.
- C. **METAL LIGHTING STANDARD ACCESSORIES:** Provide accessories for metal lighting standards, including anchor bolts, as recommended by standard manufacturer, of sizes and materials needed to fulfill loading and erection application requirements.
- D. **FINISH:** Provide factory applied powder coat paint.

CAMP WILLIAMS  
JLTC BUILDINGS 1-4  
**PART 3 - EXECUTION**

**3.01 INSTALLATION:**

- A. Install roadway and parking area lighting units as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NESC and NEMA standards, and with recognized industry practices to ensure that lighting units fulfill requirements.
- B. Coordinate with other electrical work as necessary to properly interface installation of roadway and parking area lighting with other work.
- C. Use belt slings or rope (not chain or cable) to raise and set finished poles and standards to protect finishes.
- D. Set poles and standards plumb. Support adequately during backfilling, or anchoring to foundations.
- E. Provide sufficient space encompassing hand access and cable entrance holes for installation of underground cabling where indicated.
- F. Provide Bussman HEB fuse holder with "breakaway" receptacles in all conductors running to the top of each pole. Locate fuse holder at handhole or base junction box as applicable. Provide KTK fuses in each phase conductor, sized 1.5 times maximum FLA of ballasts served by each conductor. Do not exceed rating of circuit overcurrent protective device. Make up all other splices in pole or pole base using Scotch Cast 500 Resin for watertight connection.

**3.02 ROUNDING:**

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for each roadway and parking area lighting unit as indicated.

**3.03 FIELD QUALITY CONTROL:**

- A. Upon completion of installation of roadway and parking area lighting, and after lighting circuitry has been energized with normal power source, test lighting system to demonstrate capability and compliance; otherwise, remove and replace with new units and proceed.

**END OF SECTION 16551**

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BUILDING NAME:

**UTAH NATIONAL  
 GUARD  
 JLTIC**

PROJECT TITLE:

**BUILDINGS 1-4  
 CAMP WILLIAMS**

MARK | DATE | DESCRIPTION  
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ISSUE DATE: JULY 20, 2009

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CHKD BY: TGM

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SHEET TITLE

ADDENDUM 1  
 EXHIBIT 1

SHEET NUMBER

EX-1

SHEET OF



**PLANT SCHEDULE**

TREES	BOTANICAL	COMMON	CONT	CAL	QTY
	ACER TRUNCATUM 'NORWEGIAN SUNSET'	NORWEGIAN SUNSET MAJOLE	25 GAL	27CAL	33
	KRATAEGUS CRUSGALLI 'INERBIS'	THORNLESS COCKSPUR HAWTHORN	25 GAL	27CAL	26
	MALUS HYBRID 'SPRING SNOW'	SPRING SNOW CRAB	25 GAL	27CAL	8
SHRUBS	Berberis thunbergii 'CRIMSON PYGMY'	CRIMSON PYGMY BARBERRY	5 GAL		134
	CARYOPTERIS CLANDONENSIS 'DARK KNIGHT'	BLUE MIST SHRUB	5 GAL		121
GROUND COVERS	BOTANICAL	COMMON	CONT		QTY
	ARCTOSTAPHYLOS DVA-LEISI MASSACHUSETTS	MASSACHUSETTS MANZANITA	FLAT @ 12" OC		2,193
	DELISOBERMA COOPERI	PURPLE ICE PLANT	FLAT @ 12" OC		1,432
SOD/SEED	BOTANICAL	COMMON	CONT		QTY
	POA PRATENSIS IMPERIAL BLUE	IMPERIAL BLUE KENTUCKY BLUEGRASS SOD			25,165 SF
	VARIOUS SEE SEED MIX SCHEDULE ON LS-501	NATIVE SEED MIX	SEED		22,890 SF

**HARDSCAPE SCHEDULE**

SYMBOL	TYPE	QTY
[Symbol]	1" MINUS SUNSET RED ROCK MULCH	173 CY
[Symbol]	2" COBBLESTONE	248 CY

EXHIBIT 1  
 SCALE: 1" = 30'-0"



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