

**CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS  
DIVISION 32 – EXTERIOR IMPROVEMENTS**

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**DIVISION 32 – EXTERIOR IMPROVEMENTS**

**32 08 00 – COMMISSIONING OF EXTERIOR IMPROVEMENTS**

A. Inspections

1. Paving and hardscape inspections: Coordinate with Facilities Management – Outdoor Services on inspection requirements for all paving and sidewalks.
2. Irrigation inspections: Coordinate with Facilities Management – Outdoor Services on inspection requirements for all irrigation.
3. Turf Inspection
  - a. Areas seeded in the Spring shall be inspected for required coverage the following Fall no later than October 1<sup>st</sup>. Areas seeded at any other time shall be inspected the following two summers not later than August 1<sup>st</sup>. The required coverage for the first inspection shall be ten viable live seedlings of the species specified per 900 square centimeters (approximately one square foot), or fifty percent coverage of the specified foliage cover as measured from five feet directly overhead, with no bare spots larger than 900 square centimeters which do not meet the required coverage. At the time of the second growing season inspection, there shall be seventy-five percent foliage cover of the species planted as measured from five feet directly overhead.
  - b. Determination of required coverage will be based on fixed transects, each ten centimeters in length, randomly placed in representative portions of the seeded areas, with plant species or bare ground/rock/litter being noted every ten centimeters along each transect.
  - c. Inspections for determining satisfactory lawn establishment shall be conducted by the Owner's Representative and Owner and shall meet the satisfaction of both.
  - d. After inspections, the Contractor shall perform the required maintenance within one week to insure a healthy establish seeded condition.
  - e. Contractor shall reseed lawn areas that do not meet requirements and continue maintenance until lawns are satisfactory.
4. Landscaping inspections: Coordinate with Facilities Management – Outdoor Services on inspection requirements for all landscaping and trees.

B. Commissioning of Irrigation

1. Schedule testing with the Irrigation Inspector through the University Representative a minimum of three days in advance.
2. Mainline pipe jointed with rubber gaskets or threaded connections may be subjected to pressure test at any time after partial completion of backfill. Allow irrigation pipe jointed with solvent-welded PVC joints to cure at least 24 hours before testing.
3. Subsections of mainline pipe may be tested independently, subject to review of the Irrigation Inspector.
4. Contractor shall provide clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.

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5. Hydrostatic Pressure Test

- a. Hydrostatic pressure test to be conducted for 2-1/2-inch and smaller PVC mainline pipe and for HDPE distribution pipe.
- b. Subject mainline pipe and distribution pipe to hydrostatic pressure equal to 140 PSI for two hours. Test with mainline components installed.
- c. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
- d. Purge air from mainline pipe and distribution pipe before test. Attach pressure gauge to pipe in test section.
- e. Observe pressure loss on pressure gauge. If pressure loss is greater than 5 PSI, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pressure loss is equal to or less than 5 PSI.
- f. Visually inspect irrigation pipe for leakage and replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pipe passes test.
- g. Cement or caulking to seal leaks is prohibited.

6. Volumetric Leakage Test

- a. Volumetric leakage test to be conducted for 3-inch and larger PVC mainline pipe.
- b. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
- c. Purge air from pipeline before test.
- d. Subject mainline pipe to 140 PSI for two hours. Maintain constant pressure. Test with mainline components installed.
- e. Provide all necessary pumps, bypass piping, storage tanks, meters, 3-inch test gauge, supply piping, and fittings in order to properly perform testing.
- f. Testing pump must provide a continuous 140-PSI pressure to the mainline pipe. Allowable deviation in test pressure is 5-PSI during test period. Restore test pressure to 140-PSI at end of test.
- g. Water added to mainline pipe must be measured volumetrically to nearest 0.10 gallons.
- h. Use following table to determine maximum allowable volume lost during test:

i. Allowable Leakage Table (Gallons per 100 Joints per Hour)

| Pipe Size (inches) | Test Pressure (psi) |      |      |      |      |      |      |      |      |
|--------------------|---------------------|------|------|------|------|------|------|------|------|
|                    | 60                  | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  |
| 2 1/2"             | 0.26                | 0.28 | 0.30 | 0.32 | 0.34 | 0.35 | 0.37 | 0.39 | 0.40 |
| 3"                 | 0.31                | 0.34 | 0.36 | 0.38 | 0.41 | 0.43 | 0.44 | 0.46 | 0.48 |
| 4"                 | 0.42                | 0.45 | 0.48 | 0.51 | 0.54 | 0.57 | 0.59 | 0.62 | 0.64 |
| 6"                 | 0.63                | 0.68 | 0.73 | 0.77 | 0.81 | 0.85 | 0.89 | 0.92 | 0.96 |
| 8"                 | 0.84                | 0.90 | 0.97 | 1.03 | 1.08 | 1.13 | 1.18 | 1.23 | 1.28 |
| 10"                | 1.05                | 1.13 | 1.21 | 1.28 | 1.35 | 1.42 | 1.48 | 1.54 | 1.60 |
| 12"                | 1.26                | 1.36 | 1.45 | 1.54 | 1.62 | 1.70 | 1.78 | 1.85 | 1.92 |

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- ii. Allowable Leakage is calculated using  $L = (ND\sqrt{P})/7400$ , where:
    - (1) L = Allowable Leakage (gph)
    - (2) N = Number of Joints
    - (3) D = Nominal Diameter of Pipe (inches)
    - (4) P = Average Test Pressure (psi)
  - i. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pipe passes test.
  - j. Cement or caulking to seal leaks is prohibited.
  - k. Contractor may sub-contract testing to pipeline testing company approved by Owner.
7. Operational Test
- a. Activate each remote control valve in sequence from controller. Provide either one additional personal with radio or use handheld remote to activate remote control valves from controller. Manually activating remote control valve using manual bleed mechanism at remote control valve is not an acceptable method of activation. Project Manager will visually observe operation, water application patterns, and leakage.
  - b. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.
  - c. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
  - d. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
  - e. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to Owner.
8. Central Control System Communication Test
- a. Provide one half day coordination with Project Manager to confirm Ethernet or radio communications to necessary irrigation controllers.
9. Control System Grounding
- a. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
  - b. Replace defective wire, grounding plates, or appurtenances. Repeat test until manufacturer's guidelines are met.
10. Copper Tracing Wire
- a. Test tracing wiring and document voltage reading for length of tested wire. If wire does not pass test document reason for voltage failure.
- C. Restoration and Repair of Paving, Landscape and Irrigation

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1. Projects shall bear the cost of restoration to existing landscape for damage associated with construction. Repair shall include damage outside of construction zones if damage results from some effect of project such as rerouting of pedestrian, bicycle, or vehicle traffic across a grass area in lieu of a previous path.
2. Contractors shall include restoration costs in the bid proposals.
3. Contractor may choose to have restoration work done by Facilities Management-Grounds Services through the University Representative or by a prequalified Landscape Contractor. However, competitive bidding between Facilities Management-Grounds Services and Landscape Contractors is not permitted.
4. The extent of restoration work shall be established in the following manner.
  - a. Prior to construction, the site shall be surveyed by the University Representative, A/E, Facilities Management-Grounds Services and Contractor.
  - b. The initial condition shall be documented through mutual agreement, written description, sketches, photographs and/or video.
  - c. After construction the site shall be surveyed by same group and the final condition shall be documented through same procedure.
5. Complete restoration specifications shall be included in the Construction Documents and shall be based on these Standards. Conformance shall include intermediate or temporary repairs as outlined herein. Temporary repairs may be necessary to keep irrigation systems active. Failure to do so may result in additional damage to turf and planted areas which shall require restoration work at Contractor cost.

**32 10 00 – BASES, BALLASTS, AND PAVING**

A. General

1. In general, all paving shall conform to the most recent version of the Larimer County Urban Area Street Standards (LCUASS).
2. Manhole lids, catch basins, valve boxes and all other structures penetrating any paving shall be flush to the paving surface.
3. Excavations with a volume of 50 yards or less shall be backfilled with flow-fill if the excavation is to be restored with hard surface (sidewalk or paving).
4. Excavations with a volume of over 50 yards may be backfilled with acceptable fill material but shall have compaction testing to verify an approximately 95% compaction.

B. Sidewalks

1. Sidewalks shall be a minimum of 6 feet wide with 4000 psi concrete. The concrete shall be a minimum of 4 inches thick over 3" road base. Tooled joints shall be placed at a maximum interval of 8 feet on center (both length and width).
2. Maintain a minimum of 7 foot clearance from all trees where possible. Exceptions shall be approved in advance by the University Representative.
3. Design layouts of sidewalks will have minimum radius turns of 6 feet to accommodate turning radii of tractors used for snow removal. Avoid points. Provide control joint across points.

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4. Sidewalks shall be designed with adequate jointing to prevent cracking. Expansion and contraction characteristics as well as jointing in adjacent surfaces shall be considered in development of a jointing pattern.
  5. The contractor should note that stakes driven into the ground during concrete forming sometimes puncture irrigation lines. Care should be taken to avoid this. Cost of repairs shall be the Contractor's responsibility.
- C. Dumpster Pads
1. Location of pads for dumpsters shall be determined by Facilities Management through the University Representative. Pad size will vary with each site location, but will be a minimum of 8 feet x 8 feet to a maximum of 24 feet x 17 feet and a minimum of 6 inches thick with 1.5 lbs. of "stealth" fiber mesh per yard.
  2. Design shall accommodate a direct approach by a 35 foot front-loading truck and adequate room to turn around (up to 60 feet).
- D. Bicycle Parking Pads
1. Bicycle parking is required for most buildings and activity areas. Bicycle parking pads and racks shall be indicated on site drawings and designed for two-sided use of racks. See Division 12, Section 12 93 00 for bike racks.
- E. Wheelchair Ramps
1. Curb cuts and ramps shall be placed at appropriate places for access from streets to sidewalks in accordance with ANSI Standard A 117.1 and the Americans with Disabilities Act.
  2. All primary entrances shall be accessible in accordance with ANSI Standard A 117.1 and the Americans with Disabilities Act. Ramps may be necessary, but in general, slopes requiring handrails shall be avoided wherever possible.
- F. Hot Bituminous Paving (HBP) Asphalt Streets, Parking Lots, and Driveways
1. The base course should consist of minimum 8" compacted road base.
  2. The top course of the HBP shall be a minimum of 2" and meet Grading S or SX of CDOT standards.
  3. The remainder of the HBP section shall be a minimum of 4" and meet Grading SG of CDOT standards.
  4. The above are minimum requirements. Certain areas may require a more stringent requirement based on findings from soil report.
  - 5.
- G. Transformer and Service Equipment Pads
1. Electrical transformers and service equipment placed outside of the building shall be provided with a concrete pad sized and located by the electrical engineer with approval of the University Representative.
- H. Containment Structures

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1. Concrete pads for chemical or fuel storage shall have curbs or walls built either by monolithic pour or with water stops at all joints.
- I. Bus Stop Pads
1. Bus stop pads shall be 8” thick concrete with rebar on a 2’ by 2’ grid.
  2. Size shall be 50’ in length and 12’ in width.
  3. The gutter pan shall not count toward the pad width.

**32 80 00 – IRRIGATION**

A. Sole-Sourced Products

1. Central Control Units - Motorola ICC IRRInet Control Center.
  - a. Motorola ICC IRRInet Control Center w/iRemote, w/i-ET, w/i-Pump, full software updates and support.
2. Satellite Control Unit - Motorola ICC IRRInet ACE or M, Pedestal Mount, as manufactured by Interspec, LLC. Current production only, delivered new to Owner, in manufacturer's original packaging.
  - a. Motorola ICC IRRInet M pedestal mount, AC/DC, 12/24 output, 4/8 input, to include, but not limited to the following: Motorola UHF CM200 remote radio programmed INTRAC/MDLC; iRemote compatible; 110V surge protection module, PN IS-110-ASSY; 24VAC/12VDC output/input surge protection; external I/O fuse box; Interspec powder coated green stainless steel pedestal cabinet, PN IS-1508 (39.25H X 13W X 8.5D), w/unhinged removable door; cabinet mount UHF antenna, Laird PN TRA4503P; as preconfigured, fabricated and produced by InterSpec, LLC, to Colorado State University supplied data and specifications.
  - b. Motorola IRRInet M, pedestal mount, AC/DC, 36/48/60/72 output/12/16/20/24 input, to include, but not limited to the following: Motorola UHF CM200 remote radio programmed INTRAC/MDLC; iRemote compatible; 110V surge protection module, PN IS-110-ASSY; 24VAC/12VDC output/input surge protection; external I/O fuse box; Interspec powder coated green stainless steel pedestal cabinet, PN IS-5000 (38H X 20.5W X 16.5D), with T-handle latching, locking, unhinged, removable doors (2); cabinet mount UHF Antenna, Laird PN TRA4503P; as preconfigured, fabricated and produced by InterSpec, LLC, to Colorado State University supplied data and specifications.
  - c. Motorola ICC IRRInet ACE, AC/DC, 16/32/4/60/80 output/16 input, with TCP/IP communication, to include, but not limited to the following: Motorola UHF CM200 remote radio programmed INTRAC/MDLC; iRemote compatible; 110V surge protection module, PN IS-110-ASSY; 24VAC/12VDC output/input surge protection; external I/O fuse box; Interspec powder coated green stainless steel pedestal cabinet, PN IS-5000 (38H X 20.5W X 16.5D), with T-handle latching, locking, unhinged, removable doors (2); cabinet mount UHF Antenna, Laird PN TRA4503P; Unit shall be preloaded, and provided with i-ET VANACE.PLZ, Version V3.08 or later, and shall be fully compatible with Interspec, LLC Weather Module i-ET Version V3.0.7.1466 or later; as preconfigured, fabricated and produced by InterSpec, LLC, to Colorado State University supplied data and specifications.
3. Rotor Sprinkler Heads – Hunter I-20, I-25, I-40 with check valve and stainless steel riser.

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4. Spray Sprinkler Heads – Hunter Pro Series PROS-PRS30 or Rain Bird RD Series RD-S-P30-F.
  5. Spray Nozzles – Match spray sprinkler head manufacturer. Acceptable variable arc spray nozzle: Rain Bird HE VAN.
  6. Rotor Nozzles – Match rotor sprinkler head manufacturer.
  7. Remote Control Solenoid Valves - Hunter ICV Filter Sentry ICV-FS or Rain Bird PESB.
  8. Isolation Gate Valves – Leemco LMV Series (PVC Mainline), Leemco LMV-BBHDS (HDPE Mainline).
  9. Quick Coupling Valves – Rain Bird 5LRC or Hunter HQ5LRC.
  10. Valve Boxes: Highline with lockable lid using pentagon bolts. Green color lids in turf areas and tan color lids in planting beds.
- B. Remote Solenoid Control Valves
1. Remote control valves (RCV) shall be installed according to the detail drawing shown in the installation details.
  2. All existing and new RCVs shall have valve boxes installed according to the detail drawing shown in the Drawing Appendix. Boxes shall have a minimum of 2 inches between bottom of box lid and highest part of valve. Boxes shall also have a minimum of 2 inches between bottom of box and piping. Valve boxes shall be set with lids within one half inch of compacted and settled finish grade. Boxes shall have a minimum of 4 to 6 bricks to support bottom side of box. Ground shall be hand tamped underneath valve boxes.
  3. All RCVs shall be of same sole-source brand.
  4. Whenever possible, existing galvanized fittings shall be removed and replaced with PVC.
  5. Each RCV zone shall be flushed with sprinkler heads removed.
- C. Sprinkler Heads
1. Sprinkler heads shall be placed a minimum of 3-inches from walks, unless otherwise indicated on plans, and 12-inches from building walls. Top of heads shall be placed at finished grade.
  2. Sprinkler heads shall be positioned exactly straight up and down, and be firmly tamped in place under and all around.
  3. Spray sprinklers shall have 8 to 12 inches of swing pipe, not to exceed 24 inches.
  4. Rotor sprinklers to have swing joint as presented in the installation details.
  5. Refer to the Drawing Appendix for additional Sprinkler Head Piping requirements.
- D. General Design Information
1. Irrigation systems shall be installed according to latest standards of the Irrigation Association (IA) and Association of Landscape Contractors of Colorado (ALCC).
  2. Lawn irrigation is considered a utility. Irrigation water is untreated water and people should be warned not to drink from sprinklers. In extreme circumstances, where the system does

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not reach a specific area of campus, a variance may be requested from Facilities Management to use domestic water.

3. During the growing season, turf throughout campus is watered 14 hours per day, depending on weekly schedule. In the future this utility may be tied to the energy management system computer located at Facilities Management. Until that time, system clocks must be installed in various locations around campus. The overall system is fed with untreated water and its design and materials shall be coordinated with Facilities Management-Grounds Services through the University Representative.
4. The specific design of the sprinkler system shall be done by the A/E and reviewed by Facilities Management-Grounds Services through the University Representative.
5. The construction shall include provisions for pressure checks and inspection of open trenches by Facilities Management-Grounds Services personnel.
6. Existing irrigation piping may contain asbestos. Contractors will be notified prior to construction if asbestos piping exists. If Contractor encounters unknown asbestos concrete piping, Contractor must contact Facilities Management – Ground Services personnel and CSU Environmental Health Services.

**E. Execution**

1. Irrigation control system layout will be reviewed by Facilities Management-Grounds Services after the layout is completed. Notify the University Representative three days in advance of review. Modifications may be identified at this review.
2. Bending or kinking of poly pipe weakens the pipe. All kinked pipe must be replaced.
3. Verify locations of underground utilities including the existing irrigation system components. Call 811 prior to any excavations three (3) days prior minimum to work.
4. Backfilling of new trenches shall be puddled in landscaped areas. Backfilling under pavement shall conform to requirements called out in the paving section. Provide traceable warning tape 6" above buried irrigation main lines.

**F. Salvage**

1. Existing salvageable irrigation controllers, sprinklers and valves shall be turned over to Owner unless otherwise instructed.
2. Unsalvageable items to be disposed off-site.

**G. System Damage**

1. In the event of main line damage, the Contractor will contact Facilities Management-Grounds Services through the University Representative and shall proceed with immediate repair. Facilities Management – Grounds Services will provide direction and inspection.
2. In the event of damage to irrigation lines or sprinklers, Facilities Management-Grounds Services should be contacted through the University Representative to assure Contractor repairs damage promptly and in the proper sequence. If asbestos irrigation pipe is damaged, Contractor shall stop work and notify Environmental Health Services and the University Representative.
3. Immediately upon cutting through the irrigation line, the Contractor shall cut and tape both ends such that dirt and debris cannot get into the lines. Backfill and tamp, or puddle up to



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the level of irrigation line that is to be repaired. After repair has been verified by Facilities Management-Grounds Services, backfill to grade but do not tamp directly on top of irrigation line.

H. Irrigation Control System

1. Irrigation control systems require electrical power supply. The Landscape Architect shall coordinate work with the Electrical Engineer. The electrical control wire design shall be in accordance with the NEC.
2. Provide location for irrigation controller near data room and electrical service. Provide electrical service (110V) at this location with conduit large enough to contain the valve control wires to the outside. Proper triangulated grounding of controller must be installed.
3. Facilities Management-Grounds Services through the University Representative will determine whether replacement of the control wire from a satellite controller and to a solenoid valve shall be replaced when an existing irrigation system is to be extended.
4. Test for leaks to ground per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
5. Defective wires, underground splices or appurtenance will be replaced. Tests will be repeated after replacement and approved by the University Representative.
6. Electrical conduit (below grade) shall be PVC Schedule 40 conforming to ASTM Standard D1785. Fittings shall be Schedule 40, Type 1, PVC solvent weld fittings, ASTM Standards D2466 and D1784. Above grade conduit and fittings to be rigid metal.
7. Control wires shall be prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
8. Control wire from satellite controller unit to each remote control valves for new construction shall be AWG No. 14 solid copper, Type UF cable, UL approved for direct underground burial or multi- strand type UF irrigation cable no smaller than 18 gauge.
9. Common wire from satellite controller unit to remote control valves for new construction shall be AWG No. 12 solid copper, Type UF cable, UL approved for direct underground burial.
10. All wiring sizing must conform to the manufacturers recommendations on voltage losses of solenoid valves being used and must not exceed these specifications.
11. Wires shall have same color over its entire length. Use white for common ground wire.
12. Wire splices to be Northstar Suresplice SK14-12G (orange) with copper crimps.
13. Traceable warning tape shall be buried six inches deep on top of control wiring. The traceable tape shall be inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. The traceable tape shall be three inches wide, colored yellow and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."
14. The locations of the control units on the drawings will be approximate. The Facilities Management-Grounds Department will determine the exact site locations at the system layout review. The manufacturer's representative will test for positive radio and/or data communication prior to the installation of the satellite controllers.

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15. Lightning protection: as presented in drawings and installation details.
  16. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with an identification number which consists of the name and station number of the existing controller to which the control wire had been previously connected.
  17. Bundle control wires where two or more are in the same trench at a minimum of 10 foot intervals.
  18. Refer to details for burial depths of irrigation piping and wire.
  19. Provide a 24 inch excess length of wire in an 8 inch diameter loop at each 90 degree change of direction, at both ends of sleeves and at 100 foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24 inch length of wire within each remote control valve box.
  20. Install only one control valve on each control wire.
- I. Sleeving
1. Install a separate sleeve beneath paved areas for each run of irrigation wiring bundle.
  2. All sleeves under pavement must be bedded in sand with a minimum of 6 inches above and below the sleeve.
  3. Sleeving material beneath streets, drives and pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.
  4. For solvent weld irrigation pipe: Sleeving diameter shall be a minimum of twice that of the pipe and wiring bundle, whichever is greater. Sleeves for wiring must be sized to accommodate wiring bundle.
  5. For gasketed irrigation pipe: Sleeving diameter shall be sized to accommodate restrained casing spacers.
  6. Only one irrigation pipe shall be installed per sleeve.
  7. Install sleeving at a depth which permits the encased wiring to remain at the specified burial depth.
  8. Extend sleeve ends six inches beyond the edge of the paved surface. During construction, cover sleeve ends and mark with stakes. Mark concrete with a chiseled "X" at sleeve end locations.
  9. Bore through obstructions which cannot be removed rather than alter the route. Employ equipment and methods designed for horizontal boring.
  10. Cut and patch roadways which must be crossed. Replacement asphalt and subgrade shall match existing conditions. All sleeves under pavement shall be embedded in sand with a 6 inch cover under and above sleeve.
- J. Piping
1. Lateral branch lines can be either PVC Class 160 or polypipe rated at 100 psig NSF for 3/4 and 1 inch sizes. Larger branch lines and main trunk lines shall be PVC pipe Class 200 or greater. All poly pipe of 1-1/4 inches and larger must be 80 psig NSF grade.

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2. All poly pipe fittings must be plastic-barbed, designed specifically for underground irrigation. PVC fittings shall be schedule 40, with solvent weld for all sizes 2-1/2-inches and smaller.
  3. Ductile iron fittings are required on all sizes 3 inches and larger. Ring-tight fittings shall have appropriate thrust blocking or joint restraints.
  4. All 2-inch insert fittings must be double clamped; smaller poly pipe must be single clamped with screw or pinch clamps.
  5. All mainline to have tracing wiring taped to top of pipe.
  6. Refer to installation details for pipe burial depths.
  7. Pressurized and non-pressurized pipe underneath roads shall be a minimum of 36 inches deep.
  8. Thrust blocks shall be provided on all pressurized pipe 3-inches and larger using "sacrete" remixed concrete.
  9. It is the Contractor's option to install Leemco restraint system on all 3-inch and larger mainline and ductile iron fittings in lieu of thrust blocks. If the Leemco restraint option is utilized every other pipe joint and all ductile iron fittings must be restrained using Leemco restraint system.
  10. HDPE Distribution Mainline Pipe and Fittings
    - a. Use high density, extra high molecular weight polyethylene pipe (HDPE), extruded from material meeting the specifications of cell classification on PE 4710, ASTM standard D 3350, SDR 11, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM F 714 for mainline pipe.
    - b. Join pipe lengths using butt-fusion technique as recommended by pipe manufacturer. Join HDPE to dissimilar pipe materials using HDPE (butt-fusion) x flange adapter with ductile iron back-up ring.
- K. Tools and Spare Parts
1. Contractor shall provide proprietary tools, test equipment and other parts necessary to service system. Spare parts should be provided for critical components.
- L. Record Drawings
1. Record all alterations with accurate reference dimensions, measured from at least two permanent reference points, for each controller or control unit, each sleeve end, each stub-out for future wiring connections, and other irrigation components enclosed within a valve box.
  2. Contactor must provide as-built drawings to Owner in PDF and DWG format.
- M. Warranty
1. The system shall have a one year warranty. The warranty shall include but not be limited to fill and repair depressions, restoration of landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repairs shall be made within seven days of notification from the University Representative.

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2. The sprinkler system will have a one year warranty including winterization and turn on. This work will be done by Facilities Management-Grounds Services with the contractor present for observation and instruction.

**32 30 00 – SITE IMPROVEMENTS**

- A. Site Furnishings – see Division 12, Section 12 93 00.
  1. New buildings shall have trash receptacles at the main entrances. The style of the receptacles should be compatible with the building design. Cigarette receptacles shall be a minimum of 25 feet away from entrances, operable windows, and ventilation intakes.

**32 92 00 – TURF AND GRASSES**

- A. General Information
  1. Specifications for selection and planting of sod shall be based upon the Associated Landscape Contractors of Colorado (ALCC) 2007 Handbook (or most current edition), title "The Guide for Colorado Landscape Industry Contracts and Specification". Portions of the ALCC Handbook are reprinted with ALCC's permission in following sections. Supplements or modifications have been added by Facilities Management-Ground Services.
- B. Submittals
  1. Fertilizer: Product data and manufacturer certification that product meets specification.
  2. Erosion control: Product data.
  3. Herbicide / Chemicals: Product data, MSDS, certifications of Contractor and applicators.
  4. Grass seed: Certification of seed mixture composition, seed packaging and tags, showing:
    - a. Botanical name.
    - b. Common name.
    - c. Percentage by weight of each species and variety.
    - d. Percentage of purity, germination, and weed seed.
    - e. Year of production and date of packaging.
    - f. Submit seed packaging and identification tags to Owner at completion of seeding.
  5. Qualifications of Contractor Superintendent: list completed projects with project names and addresses, names and address of architects and owners, description of project scope.
  6. Qualifications of independent testing agency for soil analysis.
  7. Soil analysis of existing topsoil, performed by a qualified independent testing agency, with interpretation of test results relative to requirements for topsoil composition and amendment.
  8. Seeding schedule and locations for each type of seed. Include anticipated dates for planting to be furnished by Owner, if any.
  9. Maintenance instructions for a full year cycle. Submit before expiration of required maintenance periods.

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C. Quality Control

1. Installer Qualifications: Minimum of five years of experience, including at least three landscaping projects similar in material, design, and extent, and a verifiable record of successful grass establishment. An experienced full-time supervisor shall be at the project when grass planting is in progress.
2. Topsoil Analysis: At Contractor cost, by qualified independent soil-testing agency and prior to any seeding, minimum of one test per project soil type, which shall include:
  - a. Percentage of organic matter
  - b. Actual percentages of inorganic matter (silt, clay, and sand)
  - c. Deleterious material
  - d. pH
  - e. CEC
  - f. DAR (sodium absorption rate)
  - g. Mineral and plant nutrient content of topsoil in PPM
3. The laboratory shall be informed of the proposed species to be planted, methods of irrigation, exposure and elevation. Based on this information the laboratory shall provide written recommendations for soil amendments, fertilizers, and report the suitability of topsoil for lawn seed and native seed growth.
4. Pre-installation conference required with CSU Facilities Management-Grounds Department.
5. All work shall be performed by personnel thoroughly familiar with the proper and accepted methods for soil preparation, herbicide applications, fertilizing, seeding, mulching, etc. All work shall be performed under the on-site supervision of the Contractor's superintendent, who shall be thoroughly familiar with the provisions of the contract.

D. Delivery, Storage, and Handling

1. Seed – Deliver seed in original sealed, labeled, and undamaged containers.
2. Storage – All materials shall be furnished in original manufactures shipping bags or containers and remain in these bags or containers until used. All materials shall be stored in a manner which will prevent them from coming into contact with precipitation, surface water, or other contaminating substances.
3. Damage in Transit and Storage – All materials which have become wet, moldy or otherwise damaged in transit, or in storage shall not be used.

E. Coordination and Scheduling

1. Planting Season – Sow lawn seed during normal planting seasons for type of seeding work required. Seeding Schedule to be provided by owner upon award of contract. Correlate seeding with specified maintenance periods to provide required maintenance from date of Conditional Completion.
2. Weather Limitations – Proceed with planting only when existing and forecast weather conditions are suitable for work.

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F. Maintenance

1. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than 60 days after date of Conditional Completion for seeded lawns.
2. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Replant bare areas with same materials specified for each seed type designated at areas per drawings. Add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
3. Contractor shall be responsible for watering of seeded areas. Apply only the amount of water necessary to maintain seeded areas in a healthy condition until the end of the warranty period. Reduce amount of water after seed is established. Prevent standing water, surface wash, or erosion from over-watering.
4. Mow lawns as soon as there is enough top growth to cut with mower set at three inch height for Bluegrass species and at height required to leave five to six inch stubble for native grass species. Repeat mowing of Bluegrass species as required, maintaining specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowing during the maintenance period. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
5. Post-fertilization – Apply fertilizer to Bluegrass lawns after first mowing and when grass is dry.

G. Seed for Turf and Grass (see seed mixes at end of section)

1. Grass Seed – Fresh, clean, dry, new-crop seed conforming to all State and Federal regulations and complying with the Association of Official Seed Analysts’ “Rules for Testing Seeds” for purity and germination tolerances.
2. Labels – All seed and seed mixes shall be furnished in bags or containers clearly labeled to show the name and address of the supplier; common, scientific and variety name(s) of the seed(s); lot number, net weight, percent of weed seed content and guaranteed percent of purity and germination. These labels shall be submitted to the Owner’s Representative ant the completion of each seeding phase.
3. Certification of Seed Testing – The Contractor shall furnish a signed statement to the Owner’s Representative certifying that the seed furnished is from the lot that has been tested.

H. Topsoil: Use existing on-site soils. Amend existing, stockpiled and spread topsoils.

I. Soil Amendments

1. Organic Compost – Thoroughly rotted, decomposed, stable, weed free organic matter source derived from agricultural, food, or industrial residuals; yard trimmings, or source-separated or mixed solid waste. This product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost shall possess no objectionable odors and shall not resemble the raw material from which it derived. The compost parameters shall be as follows:
  - a. PH Range: 5.5 – 8.0

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- b. Moisture Content: 35% - 55%
  - c. Particle Size: Pass through 1 inch screen or smaller
  - d. Stability: Stable to highly stable, providing nutrients for plant growth
  - e. Maturity/Growth Screening: Demonstrate ability to enhance plant growth
  - f. Soluble Salt Concentration: 4.0 dS (mmhos/cm) or less preferred
2. Local source shall be A-1 Organic, Eaton, Colorado or an approved equal.
  3. **Submit preliminary sample for approval during submittal phase, followed by pre-application verification sample originating no more than two weeks before application.**
- J. Water
1. Non-potable water from CSU irrigation system.
- K. Fertilizer
1. Any fertilizer specified by the Owner's Representative shall be applied and mixed with the soil during soil amendment and preparation. All fertilizers shall be applied using standard application equipment at rates specified. Application rates shall be specified by Owner's Representative based on recommendations of the soils testing laboratory with approval of the owner.
  2. Fertilizer shall be a standard commercial product of uniform composition, free flowing and conforming to applicable State and Federal laws. Deliver in original, unopened containers unless provisions are made and approved by the Owner for bulk deliveries to the site. No Cyanamid compounds will be permitted in mixed fertilizers.
  3. Submit manufacture's guaranteed analysis, name, trademark, and conformance to State law for all fertilizers.
- L. Mulches
1. Hay or Straw Mulch shall be air-dry, clean, mildew and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley. At least seventy (70%) percent of the mulch shall be ten inches or more in length. Mulch shall not contain any noxious weed, must, cake, or decay.
- M. Erosion Control Materials
1. May be required for stabilizing land disturbed areas in certain areas.
  2. Blankets – On slopes exceeding 1:4, biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
  3. Fiber Mesh – Biodegradable twisted jute or spun-coir mesh, .092 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 Inches (150 mm) long.
- N. Preparation

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1. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
  2. Protect structures, utilities, sidewalks, pavements, facilities, trees, shrubs, and plantings.
  3. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
  4. All ripping and tilling operations shall be done in a direction which follows the natural contours of the land on slopes of three to one (3:1) or less. Soils on slopes greater than three to one (3:1) will be prepared for planting in a manner specified by the Owner's Representative. Any irregularities in the ground surface resulting from soil preparation operations shall be corrected and sloped to drain.
  5. Limit sub-grade preparation to areas that will be planted in the immediate future.
  6. Compacted soils shall be ripped or tilled to a depth of six inches to break up restrictive layers prior to seeding operations. All other soils shall be tilled to a depth of six inches. The soils shall be worked until no clods greater than two inches in diameter remain, unless directed otherwise by the Owner's Representative. Remove stones larger than one and one-half (1-1/2") inches in any dimension and sticks, roots, rubbish, and other extraneous matter.
  7. Mix soil amendments and fertilizers with topsoil. Mix soil amendments at a rate of four cubic yards per 1,000 square feet of area. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and till thoroughly into top four inches of topsoil before planting. Top-dress newly seeded areas with 1/4" layer of fine compost, then water.
  8. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or sub-grade is frozen.
  9. Grade lawn and native grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2" in any dimension, and other objects that may interfere with planting or maintenance operations.
  10. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
  11. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.
- O. Seeding New Lawns
1. Dry Land Seeding – All seed is to be drilled 0.25 inch to 0.50 inch into the soil at the specified PLS/acre rate with a mechanical, power-driven drill. Rows shall be spaced not more than seven inches apart. If using a range drill, the Contractor shall drill one-half of the required PLS/acre in one compass direction and then drill the remaining half of the required PLS/acre in a direction 90 degrees to the first half.
  2. Broadcast Seeding – Some areas may be inaccessible to a drill. In these areas, which shall be in agreement between the Contractor and the Owner's Representative, seed shall be uniformly broadcast at the specified PLS/acre evenly distributed by sowing seed in



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equal quantities in two directions at right angles to each other. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Cover seed with soil to a depth of 0.25 to 0.50 inch.

3. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
4. Sow seed at the rates indicated in seed mixture schedules at the end of this Section.
5. Protect seeded slopes exceeding 1:4 against erosion with erosion control blankets installed and stapled according to manufacturer's recommendations.
6. Protect seeded slopes exceeding 1:6 against erosion with jute or coir-fiber erosion control mesh installed and stapled according to manufacturer's recommendations.
7. Protect seeded areas with slopes less than 1:6 against erosion by crimping straw mulch immediately after completion of seeding operations. Spread uniformly at a rate not to exceed two tons per acre (45 kg per 100 sq. m) to form a continuous blanket 1-1/2 inches loose depth over seeded areas. Spread by hand, blower, mechanical spreader, or other suitable equipment.

P. Herbicide / Chemical Application

1. EPA registered and approved, of same type used by Colorado State University Facilities Management Outdoor Services. Coordinate with CSU Grounds.
2. Herbicides and other chemicals, if used, shall be applied using well-maintained spraying equipment by individuals working for the Contractor who are appropriately licensed by the State or Federal agency having jurisdiction over such applications. It shall be the responsibility of the Contractor to be knowledgeable of any and all current laws and regulations pertaining to herbicide and other chemical applications, and to advise the Owner's Representative immediately if any requests for these applications made by the Owner's Representative are inappropriate as they pertain to these laws and regulations.
3. Herbicides and other chemical shall not be applied during periods when wind or other physical conditions cause the herbicides to be transported a distance of more than five feet from the immediate area where they are being applied. It shall be the responsibility of the Contractor to notify the Owner's Representative immediately if any weather or other physical condition exists which would make applications inappropriate.
4. All herbicides and other chemicals shall be applied at rates as determined by Owner and Owner's Representative.

Q. Disease and Insect Control

1. Apply fungicides and insecticides as required to control diseases and insects by a licensed applicator in accordance with State law requirements.

R. Cleanup and Protection

1. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas. Perform daily cleaning during installation of the work, and upon completion of the work. Remove and haul from the site all excess materials, debris, and equipment. Repair damage to structures.

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2. Protect seeded areas from unnecessary pedestrian or vehicular traffic until well established through the use of fenced, barricades, and signage. Provide any additional erosion control measures which are necessary for the successful establishment of grass areas.
- S. Sod
1. Sod used for the repair or replacement of existing sod shall match the pre-existing or surrounding sod. New sod shall be equivalent of a ninety-nine percent improved variety Bluegrass sod or as specified by Facilities Management-Grounds Services through the University Representative.
  2. The sod shall have a vigorous and healthy root system that has been regularly watered, mowed, fertilized and sprayed for weeds in the sod nursery. Each piece of sod shall be free of objectionable weeds. The sod shall be such that it will not tear, break or crumble during the handling and placing of the sod. Unless short and smooth, the grass shall be clipped with a lawn mower to a height of two inches before it is lifted. The sod is to be cut evenly not more than one inch thick and cut in strips approximately eighteen inches in width.
  3. Sod left out for more than 24 hours shall not be used without approval of Facilities Management-Grounds Services through the University Representative. Sod in rolls shall be kept moist and protected from exposure to sun, wind and heat. All sod transported in open vehicles for a distance of more than 25 miles must be properly protected. All sources of sod shall be made known to Facilities Management-Grounds Services through the University Representative 3 business days in advance of cutting.
  4. Soil amendment materials shall be spread over the surface of the ground of the areas to be covered at the minimum rate of four cubic yards per thousand square feet. The areas shall then be thoroughly tilled a minimum of 4 inches to a maximum of 6 inches deep.
  5. All sticks, stones and other debris appearing on the surface or larger than 1 inch in any dimension shall be carefully removed. The entire surface shall then be carefully bladed so that no unevenness appears. The Landscape Contractor shall finish grade in accordance to grading plan and shall remove any high or low spots to obtain an even surface.
  6. Sod bed shall be smooth before any sodding is to be done. If slopes are steeper than 2:1, the sod bed shall be lightly and sufficiently watered. The sod shall be laid by staggering joints. On any slopes, the sod shall run parallel to a ninety degree angle to the slope.
  7. When in position, the sod shall be watered, then rolled and/or tamped into contact with the soil, so that no open joints are apparent.
  8. Watering: The Landscape Contractor shall water the sod lightly and sufficiently to a depth of 2 inches, but with care so that no erosion takes place and so that no gullies are formed. The sod shall then be watered in early morning and afternoon for at least five successive days after lying to establish the lawn as determined by Facilities Management-Grounds Services through the University Representative. During hot weather, the sod should be kept moist by Facilities Management-Grounds Services and not allowed to dry out for a minimum of three weeks. Mowing height should not be less than two and one-half inches.
  9. Maintenance: After sod has been installed the Contractor shall be required to maintain the sod until the time of substantial completion of the project. Maintenance includes irrigation, mowing and rolling. Mowing shall be required a minimum of once per week and cut to a height of 2-1/2 to 3 inches. Rolling shall be required only once after installation of sod.

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10. Guarantee: Any sod that has failed to survive one month after laying shall be replaced and established at the proper season by the Landscape Contractor and at the Landscape Contractor's expense.

T. CSU Sports Blend

1. Seed mix shall be seeded at 3.0 PLS per 1000 Square feet:

a. Sports Blend Table

| SPECIES            | VARIETY     | % MIX |
|--------------------|-------------|-------|
| Kentucky Bluegrass | Avalance    | 25.00 |
| Kentucky Bluegrass | Rugby II    | 25.00 |
| Kentucky Bluegrass | P105        | 25.00 |
| Kentucky Bluegrass | Wild Horse  | 10.00 |
| Perennial Ryegrass | SR4600      | 07.50 |
| Perennial Ryegrass | Manhattan 5 | 07.50 |

U. CSU Foothill Campus native seed mix

1. Seed Mix:

a. Original Seed Mix Table

| COMMON NAME        | SCIENTIFIC NAME        | PLS #/ACRE |
|--------------------|------------------------|------------|
| Western Wheatgrass | Agropyron smithii      | 6.6        |
| Slender Wheatgrass | Agropyron trachycaulum | 4.5        |
| Blue Gramma        | Bouteloua gracilis     | 1.0        |
| Mountain Brome     | Bromus marginatus      | 10.0       |
|                    | TOTAL PLS #/ACRE       | 22.1       |

b. Shorter Seed Mix Table

| COMMON NAME           | SCIENTIFIC NAME    | PLS #/ACRE |
|-----------------------|--------------------|------------|
| Western Wheatgrass    | Agropyron smithii  | 6.6        |
| Streambank Wheatgrass | Agropyron riparian | 7.5        |
| Blue Gramma           | Bouteloua gracilis | 1.0        |
| Sheeps Fescue         | Festuca ovina      | 12.0       |
|                       | TOTAL PLS #/ACRE   | 27.1       |

2. Cover Crop: Spring Wheat @ 10 PLS#/ACRE

3. Seedbed Preparation: Areas of compassion shall be ripped or disced. Surface irregularities shall be smoothed. Surface ridge roughness will be left to the prevailing winds and/or to steep slope direction.

4. Method of Seeding: Seed mix shall be drilled.

5. Mulch: Mulch shall be conventionally blown certified weed free straw mulch applied at a rate of 1.5 tons per acre and crimped.

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**32 93 00 – PLANTS**

A. General Design Information

1. All landscape designs shall be reviewed by Facilities Management's Landscape Architect through the University Representative for conformance with the Landscape Master Plan.
2. Protection of site and existing landscape features, especially trees, will be paramount for each project. These must be specifically discussed in detail in the specifications.
3. Isolated islands or berms etc. are labor intensive and should be avoided. The design should be kept in context with adjacent spaces.
4. Specific responsibility for landscape design and documentation shall be agreed to during contract negotiations.
5. A preliminary landscape plan shall be prepared by a landscape architect with generic descriptions to be used in discussing design concepts prior to doing detailed planting plans.
6. Specifications for selection and planting of trees and shrubs shall be based upon the Associated Landscape Contractors of Colorado (ALCC) 1991 handbook The Guide for Colorado Landscape Industry Contracts and Specification. Portions of the ALCC Handbook are reprinted with ALCC's permission. Supplements or modifications have been added by Facilities Management-Grounds Services.

B. Tree Layout

1. The use of street trees is encouraged in all designs and will be coordinated with the Landscape Architect and University Representative.
2. The base of all trees in lawn areas must have a 3 foot diameter circle of shredded wood mulch installed at a 3-4 inch depth.
3. The Facilities Management-Grounds Services personnel will participate, at the direction of the University Representative, in the selection and tagging of trees at the nursery to be used in the project. The Contractor must coordinate this prior to any trees arriving on site.
4. The following table identifies the minimum and recommended tree clearances.

a. Tree Clearance Table

|                                | Minimum (feet) | Preferred (feet) |
|--------------------------------|----------------|------------------|
| Curbs                          | 5 CE           | 7-8 CE           |
| Sidewalks                      | 5 CE           | 7-8 CE           |
| Electric buried cable          | 4 CC           | 5-6 CC           |
| Water lines                    | 6 CC           | 7-8 CC           |
| Sewer lines                    | 10 CC          | 10+ CC           |
| Steam/condensate lines         | 10 CC          | 15+ CC           |
| Gas lines                      | 4 CC           | 5-6 CC           |
| Street lights-shade trees      | 40 CC          |                  |
| Street lights-ornamental trees | 15 CC          |                  |
| Street signs                   | 7 CC           |                  |
| Intersections                  | 30 CE          |                  |

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|                           |         |       |
|---------------------------|---------|-------|
| Vaults and pits           | 5-10 CE | 10 CE |
| Tree to tree - shade      | 30 CC   |       |
| Tree to tree - ornamental | 15 CC   |       |

- b. CE = center of tree to edge.
  - c. CC = center of tree to center.
  - d. EE = edge of tree to edge.
5. Trees that are donated as a memorial may be identified with a plaque that adheres to Facilities Management established standards. Memorial trees will be identified and tracked on the Facilities Geographic Information System (GIS).

**C. Landscape Requirements**

- 1. Edging materials are only used as specified by each individual project. Edging is generally not used around shrub beds. Where turf is adjacent to buildings, a 12" wide mowing strip is required. Mowing strips and edgings are generally not used around planting beds. When specified, edging may be 6 x 8 inch pressure treated timbers, concrete curbing 1-1/2 inches high or flexible edging 4 inches high at planting beds. Buildings should be edged with a 12 inch wide concrete strip. Mowing strips under fences shall be concrete 12 inches wide. Type of edging to be determined by Facilities Management-Grounds Services through the University Representative during review. Metal edging is prohibited without specific approval.
- 2. Shrub beds shall be mulched with wood mulch. No gravel mulch is permitted without prior approval. Wood mulch in shrub beds should be three to four inches in depth. Fabric weed barrier is generally not used.

**D. Protection and Preservation of Existing Trees**

- 1. All site or landscape plans should show all existing trees. Trees to be saved or removed should be indicated.
- 2. Trees to be saved shall have a properly constructed barricade which protects the total area within the dripline. The dripline is defined as the area on ground covered by spread of branches. Barricades shall be erected prior to construction/excavation.
- 3. If there is limited space on a site, and passage beside a tree is mandatory, a bridge is to be constructed over the root zone, and boards used to protect the trunk. Refer to the Drawing Appendix.
- 4. No equipment or materials, including excavated soil, shall be parked or stored within the dripline of a tree.
- 5. When raising the grade around a tree, a dry well is required. When lowering the grade around a tree, a retaining wall is required. In such instances, approval by, and coordination with Facilities Management-Grounds Services is required. Refer to the Drawing Appendix.
- 6. Trenching should be done outside the dripline of trees. If a trench cannot be routed around a tree, tunnel under it. Trenching within the dripline is generally prohibited. Trenching or boring will be permitted inside the dripline of a tree only with approval from Facilities Management-Grounds Services through the University Representative.

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7. After trenching outside the dripline of a tree, any severed roots should be cut again smoothly and with flush cuts. Next, trenches should be backfilled as soon as possible so tree roots will not dry out.
8. Where possible, curbs should not be closer than 7 feet from the trunk of the tree. No paving or asphaltting should be done closer than 7 feet from the tree trunk.
9. New sidewalks, paving or asphaltting must allow porous space for existing tree roots. For trees up to 4 inches in trunk caliper, a minimum of 25 square feet of porous area is required. For each additional 2 inches of tree caliper, provide an additional 10 square feet.

**E. Selection of Plants**

1. All plants shall conform to the following specifications adapted from the ALCC Handbook and to the American Standard for Nursery Stock, 2014 Edition. Plants shall be supplied from propagating houses, beds, frames or nurseries. "Collected" stock will not be accepted unless specified or approved as a substitute.
2. All plants shall have well-formed buds with size normal for the species. Growth increments of shoots for the previous year shall be of a size normal for the season, with no evidence of stunted growth. Plants shall not have been in storage for more than one growing season.
3. All plants shall be sound, healthy, vigorous and free of harmful insects, diseases and major mechanical injuries. Major mechanical injuries meaning damage to trunk or branches to the extent it would affect normal growth and/or appearance or would require pruning or wound treatment.
4. Plants shall be symmetrical and typical for species and variety. Trees planted in rows shall be consistent in branching habit, size, form and height.
5. Plant sizes shall be specified.
6. Plants shall be selected from specified growing areas as defined below.
  - a. Colorado Grown - plants grown in Colorado nursery fields for the major portion of their life.
  - b. Colorado Fielded - plants shipped in, which have grown in Colorado for one full growing season or more prior to delivery.
  - c. Northern Grown - plants grown in nurseries one year or more located in Hardiness Zones 1 through 5, as shown in USDA Map.
7. Alternate plants may be proposed by the Contractor if specified types are not available. Approval of substitutes shall be made by the University Landscape Architect through the University Representative.

**F. Transportation of Plants**

1. Conform to the minimum standards set forth in the most recent revision of the Rules and Regulations of the Colorado Nursery Act for:
  - a. All plants specified as dug before transport.
  - b. All plants specified in containers.
  - c. All plants specified as balled and burlapped.

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2. All plants, bare root, container or balled and burlapped shall be protected from the time of digging to the time of planting from any conditions that would be adverse to the continued growth of the plant. Delivery and planting must be scheduled and coordinated with other landscape work.
- G. Selection Inspection and Guarantee
1. Facilities Management Landscape Architect will participate, through the University Representative, in the selection and tagging of the plants and trees at the nursery. The Contractor must coordinate this prior to any trees arriving on site.
  2. The Contractor shall guarantee all plants to be true to name and to meet all conditions of specifications.
- H. Planting
1. Prior to any excavation, all underground utilities shall be identified by Facilities Management-Utilities Services through the University Representative according to the Utility Locate procedure described in Division 01 – General Requirements.
  2. Percolation test shall be provided to check for adequate air and water movement. If site soil fails the test the Contractor shall notify Facilities Management-Grounds Services through the University Representative. Improvement of soil drainage shall be performed prior to planting and may require recommendations from a soil testing laboratory and/or an agricultural drainage consultant.
  3. Locations for plants shall be verified and staked according to the landscape plan. Facilities Management-Grounds Services personnel, through the University Representative, shall be notified prior to planting to observe locations.
  4. Plants which have been container grown and balled and burlapped shall be planted as follows.
    - a. In clay or clay loam soil, the planting pit shall be made 2 inches shallower than the height of the soil ball and a minimum of 1 foot larger in diameter.
    - b. In sandy loam soil, which is well drained, the planting pit depth shall be no deeper than the height of the root ball and a minimum of 1 foot larger in diameter.
    - c. Container plants shall be removed and the fibrous roots teased, manipulated or scarred with a knife to discourage circling roots. Care should be taken not to break the root ball.
    - d. Balled and burlapped plants shall be set in the planting pit at the proper depth and all twine removed from the trunk, and excess burlap cut from the top of the root ball prior to backfilling. Place the balled tree in the hole at the proper depth, backfill and compact the soil up to the first tier of wire above the bottom of the ball to stabilize it. Remove upper two-thirds of wire and burlap, then backfill and compact the soil up to approximately one-third of the bottom portion of the ball. Finish backfilling with loose soil and thoroughly puddle with water.
  5. Bare root plants shall have backfill soil amended according to recommendations of Facilities Management-Grounds Services through the University Representative. Backfill shall be added and watered thoroughly, settle soil with water to eliminate all air pockets. Do not compact backfill by tamping. If area is irrigated, then do not provide a basin. If area is not irrigated, then form a basin for water.

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6. Backfill amendments shall be of a consistency to allow for air and water movement without compacting.
  7. Staking, guying and tree wrap shall conform to Details L-8 through L-11 in Appendix A. Trees shall be wrapped with the approved standard 4 inch crepe wrap. Wrap from the ground line up to the second whorl of branches and secure. Apply wrap approximately November 1 and remove approximately April 1 of the following year. Where guy wires are used, they shall be flagged with a conspicuous material and replaced as required by Facilities Management-Grounds Services through the University Representative until guy wires are removed.
  8. Pruning shall be provided to any injured or broken roots or branches. These shall be trimmed to a clean, smooth cut. Evergreens shall have only damaged branches trimmed in a manner that the form of the tree is not affected.
  9. No hole or pit shall remain open without safety devices to protect the Owner from liability for personal accidental injury.
- I. Guarantees
1. All nursery stock shall be guaranteed for one full year. The guarantee shall be a full, 100 percent replacement guarantee on plant material. Installation labor shall also be included in the guarantee.