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12. Landscape Architecture and Irrigation Systems

12.1 Landscape Architecture

12.1.1 General

City shall require submittal of L&I plans for any system that is located within City ROW and/or will become owned, operated and maintained by the City of Bend. Landscape Architects are responsible for knowing and applying best practices of the Oregon State landscape Architects Board (OSLAB) in preparing landscape designs for all public right-of-way projects for the City of Bend. Minimum general specifications for construction shall be set forth in the Oregon Standard Specifications (OSS) for Construction and these City of Bend Standards and Specifications.

The purpose of these guidelines is to develop attractive community environments that improve public safety by preventing sight distance and facility obstructions and sidewalk and street damage, promote the use of native and drought-tolerant landscape species, minimize maintenance costs, and use the current irrigation technologies to reduce water consumption.

For capital improvement and development projects, the following design requirements shall be implemented in all design deliverables and submittals presented to the City of Bend for review.

12.2 Scope

The design standards apply to all City of Bend public right-of-way projects, and include, tree and native plant habitat protection, removal of trees and landscaping materials, plant selection, and tree spacing, as well as the safety of the public and city maintenance staff. These design standards are in addition to and complement the existing Bend Code, Chapter 10-10, Sections 3.2.100 – 3.2.500.

12.3 Design Parameters

The landscape design criteria for public right-of-way projects shall conform to the current City of Bend specifications, codes and ordinances of the City of Bend. Landscape architects are responsible for knowing and applying best practices of the Oregon State landscape Architects Board (OSLAB) in preparing landscape designs for all public right-of-way projects for the City of Bend. Minimum general specifications for construction shall be set forth in the Oregon Standard Specifications (OSS) for Construction and these City of Bend Standards and Specifications.

The purpose of these guidelines is to develop attractive community environments that improve public safety by preventing sight distance and facility obstructions and sidewalk and street damage, promote the use of native and drought-tolerant landscape species, minimize maintenance costs, and use the current irrigation technologies to reduce water consumption.

For capital improvement and development projects, the following design requirements shall be implemented in all design deliverables and submittals presented to the City of Bend for review.

12.3.1 Stormwater Source Control Principles

The landscape plan shall adhere to current stormwater quality source control principles for low impact development including but not limited to identifying the development/building envelope, designing with the natural topography, minimizing impervious areas, working to minimize the volume and velocity of stormwater runoff through features such as canopy coverage and infiltration, where appropriate, and incorporating treatment through soils.
12.3.2 Xeriscaping Principles

The landscape plan shall adhere to current water conservation principles for "xeriscape design," including, but not limited, to microclimatic conditions in the site design process, grading, plant selection, soil amendments, and material selection.

12.3.3 Hydrozoning

The landscape design shall select and place plants with similar sun, soil, and irrigation requirements in "matched zones" (hydrozones) to minimize the construction costs for irrigation installation and long-term maintenance requirements. Trees shall have separate zones from shrubs and trees. The City of Bend recognizes the following hydrozone classifications: "Very Low"– native vegetation, "Low"– adapted drought-tolerant vegetation, "Medium"– ornamental species not adapted, "High"– turf and non-adapted high water needs plants.

12.3.4 Tree and Native Habitat Protection

Landscape designs shall consider the protection of existing established native species that are located, standing, or growing within or upon any City of Bend public right-of-way, when feasible. Tree species, other than those identified by the Oregon Invasive Species Council (OISC) as an invasive species, with a caliper above 6-inches, (measured 4-feet above existing grade) and native shrub zones that are healthy, noninvasive, and located in areas that do not interfere with clear vision standards, intersection sight triangles, and intersection sight distances", shall be used and protected in the design.

The landscape plan shall include the species, size, and location of existing trees that are 6-inches or greater in caliper. If no existing trees are present that require protection, a note shall be included on the plan stating that no existing trees require protection.

When existing native vegetation is preserved as part of the overall landscape plan for public right-of-way projects, the Landscape Architect shall include design details and/or notes, construction activity controls and measures, and any necessary provisions or restrictions to ensure protection to within 20-feet of the existing drip line for existing trees; and 10-feet from existing native shrubs, ground cover, and grass species or existing landscape features (such as rock outcroppings).

The landscape plan shall note a requirement for the City to be notified within 24 hours of any suspected damage to existing trees within the project area that were not identified and approved for removal or relocation. If damage occurs during construction, the construction applicant shall have the tree restored within 24 hours by a certified arborist.

The landscape plan shall note the protective measures to be taken during construction concerning storage of materials, soil, equipment, or any other supplies to prevent damage at or within the drip line of existing trees.

12.3.5 Tree Removal and Relocation

All applicants must submit a plan, along with the development application, to the City of Bend demonstrating the need to remove or relocate existing trees over 6-inches in caliper. As stated in the Bend Code – Chapter 10-10, Section 3.2.200, Landscape Conservation (B), “significant vegetation” means individual trees with a specific trunk caliper of 6-inches or greater diameter at breast height (DBH); that is, 4 feet above the ground.
The City of Bend standard does not allow for tree removal or relocation within the public right-of-way. Deviation from this standard shall require a Standards Deviation from the City Engineer based on the following criteria: (1) the site cannot feasibly be developed, either by alternative site design or construction changes, without removing or relocating existing trees; (2) if the trees remain in their present location, the final construction project will so undermine their viability that they will become a danger in the future; or (3) the existing location is determined to be within the clear vision standards, intersection sight triangles, and intersection sight distances (for traffic, bicycles, and/or pedestrians and causes a safety concern, and pruning cannot solve the issue.

Removal of existing trees that meet the removal criteria will require City approval. Existing trees approved for removal or relocation shall be clearly identified on the landscape plan. The City shall be notified 48 hours in advance of any approved tree removal activity.

12.3.6 Street Trees and Plants

12.3.6.1 General

Street trees shall be required to be designed and planted with all public-right-of-way projects. They may be located within the right-of-way as indicated in 14.3.9, or located in the front yard setback or buffer area immediately adjacent to the right-of-way, as stated in the Bend Development Code Chapter 10-10, Section 3.2.400, Street Trees. Deviation from this standard shall require a Standards Deviation from the City Engineer. Trees and plant species selected for use in non-paved public right-of-way projects shall be selected for their durability, drought tolerance, proportionality to site circumstances, low maintenance, and clearance standards for pedestrian, bicycle, and vehicular traffic safety.

The publication titled "An Introduction to Xeriscaping in the High Desert and Pictorial Plant Guide for Central and Eastern Oregon" by the Oregon State University Extension Service is recommended as a guidebook for plant selection. Copies of the publication are available at the City of Bend Planning Department and OSU Extension Service.

All trees and plants considered shall be hardy to USDA Zone 5.
12.3.6.2 Minimum Plant Sizes

The following are minimum plant sizes for all required landscape areas:

- **Shade trees**: (25’ high or taller – at maturity) 2-1/2-inch caliper
- **Ornamental trees**: (12’ – 25’ high - at maturity) 2-inch caliper
- **Evergreen trees**: 8-foot height
- **Woody shrubs**: 2 gallon
- **Ground covers and ornamental grasses**: 1 gallon

12.3.7 Approved Street Tree List

12.3.7.1 General

Proposed street trees shall be selected from Table 14-1, Approved Street Trees List, in the Bend Design Standard, expanded from the list found in the Bend Code, Chapter 10-10, 3.2.400, Street Trees, unless the City has approved an alternate selection by a special improvement plan or other City-adopted subcommunity. The approved species have proven to be hardy in our region and are recommended "xeric" species in the Oregon State University Extension Service publication, "An Introduction to Xeriscaping in the High Desert and Pictorial Plant Guide for Central and Eastern Oregon." Other plant species may be proposed as alternate selections by the Landscape Architect, subject to City Planning Director approval, to be substituted for species on the list. Alternative proposed tree species and varieties shall be thornless, cottonless, low-pollen, low-maintenance, noninvasive, minimally fruiting /seeding, and single trunk forms.

The City of Bend encourages the use of drought-tolerant species whenever possible. Native or plants adapted to Central Oregon are preferred for right-of-way applications. Xeric tree species (low water requirements) are listed in Table 14-1 in these Standards.

The City discourages the planting of street trees in landscaped areas or planting strips that are less than 4-feet wide. Trees selected for narrow areas between 4 and 6 feet or any narrow area should be upright forms of approved tree species.

Evergreen trees shall not be approved for right-of-way applications with landscape strips less than 20–feet wide or near intersections.

The City recognizes that new plant varieties are being produced every year that would be valuable additions to the public landscape that are not listed on the “Approved Tree List” in Table 14-1. The City will consider alternate tree species and varieties that are site-appropriate, drought-resistant, and pest- and disease-resistant. Alternate selections shall only be used when an approved Deviation from Standards and Specifications request has been submitted and approved.

12.3.8 Non-approved Street Trees and Plants

Tree species that will not be approved for use in the public right-of-way include the following: Cottonwood (*Populus*), Quaking Aspen (*Populus tremuloides*), Box Elder (*Acer negundo*), Chinese Elm (*Ulmus parvifolia*), Siberian Elm (*Ulmus pumila*), Lombardy Poplar (*Populus nigra “Italica”*), Russian Olive (*Elaeagnus angustifolia*), and Willow (*Salix*) species.

No tree or plant that the OISC has identified as "invasive" will be approved but are encouraged where adequate room allows.
Evergreen trees shall be considered on a case-by-case basis, but generally are discouraged for medians, rights-of-way, and landscape strips less than 20-feet wide, because of the potential for sight obstruction and maintenance considerations from needles and cones.

http://www.ci.bend.or.us/depts/community_development/docs/Tree_Permit_Application_11_09.pdf

TABLE 14-1
Approved Street Tree List

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Mature Height/Width</th>
<th>Water Requirement</th>
<th>Minimum Planter Width</th>
<th>Grow Under OH Wires</th>
<th>City Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer campestre</td>
<td>Hedge maple</td>
<td>30’ – 30’</td>
<td>Medium</td>
<td>8 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer circinatum</td>
<td>Vine maple</td>
<td>20’ – 15’</td>
<td>Medium</td>
<td>8 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer glabrum</td>
<td>Rocky Mountain maple</td>
<td>15’ – 12’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer tartaricum</td>
<td>Tartarian maple</td>
<td>20’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer ginnala</td>
<td>Amur maple</td>
<td>20’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer ginnala</td>
<td>Flame Amur maple</td>
<td>20’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Acer nigrum</td>
<td>Green Column Black maple</td>
<td>40’ – 25’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer rubrum</td>
<td>Red maple</td>
<td>50’ – 40’</td>
<td>Medium</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer x fremanii</td>
<td>Autumn Blaze maple</td>
<td>40’ – 30’</td>
<td>30’ Medium</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer x fremanii</td>
<td>Columnar Red maple</td>
<td>40’ – 10’</td>
<td>Medium</td>
<td>4 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer platanoides</td>
<td>Norway maple</td>
<td>50’ – 40’</td>
<td>Medium</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer platanoides</td>
<td>Crimson King maple</td>
<td>40’ – 40</td>
<td>Medium</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acer platanoides</td>
<td>&quot;Emerald Queen&quot; maple</td>
<td>40’ – 25’</td>
<td>Medium</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Aesculus glabra</td>
<td>Ohio buckeye</td>
<td>25’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Amelanchier x grandiflora</td>
<td>Autumn Brilliance serviceberry</td>
<td>25’ – 15’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Amelanchier x grandiflora</td>
<td>Spring Flurry serviceberry</td>
<td>25’ – 15’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditionala</td>
</tr>
<tr>
<td>Carpinus carolina</td>
<td>American hornbeam</td>
<td>30’ – 25’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
### TABLE 14-1
Approved Street Tree List

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Mature Height/Width</th>
<th>Water Requirement</th>
<th>Minimum Planter Width</th>
<th>Grow Under OH Wires</th>
<th>City Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cercis canadensis</td>
<td>Eastern Redbud</td>
<td>25’ – 25’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Crataegus crusgali inermis</td>
<td>Cockspur hawthorn</td>
<td>25’ – 25’</td>
<td>Low</td>
<td>8 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Crataegus ambigua</td>
<td>Russian hawthorne</td>
<td>20’ – 12’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Crataegus viridis</td>
<td>Winter Kinghawthorn</td>
<td>25’ – 15’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica</td>
<td>Green ash</td>
<td>50’ – 40’</td>
<td>Medium</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica</td>
<td>Marshall Seedless ash</td>
<td>40’ – 35’</td>
<td>Low</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica</td>
<td>Summit ash</td>
<td>40’ – 25’</td>
<td>Low</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica</td>
<td>Patmore ash</td>
<td>40’ – 35’</td>
<td>Low</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fraxinus americana</td>
<td>Autumn Purple ash</td>
<td>40’ – 30</td>
<td>Low</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gleditsia trianths inermis</td>
<td>Shademaster honeylocust</td>
<td>40’ – 40’</td>
<td>Low</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gleditsia trianths inermis</td>
<td>Skyline honeylocust</td>
<td>40’ – 35’</td>
<td>Low</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gleditsia trianths inermis</td>
<td>Sunburst honeylocust</td>
<td>35’ – 30’</td>
<td>Low</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gymnocladus dioica</td>
<td>Kentucky Coffee tree</td>
<td>80’ – 45’</td>
<td>Low</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Malus hybrids</td>
<td>Variety</td>
<td>20’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Populus tremula</td>
<td>Swedish Aspen “Erecta”</td>
<td>35’ – 12’</td>
<td>Medium</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Prunus maackii</td>
<td>Amur chokecherry</td>
<td>25’ – 20’</td>
<td>Medium</td>
<td>6 feet</td>
<td>Yes</td>
<td>Conditional(^a)</td>
</tr>
<tr>
<td>Prunus virginiana</td>
<td>Canada Red chokecherry</td>
<td>30’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pyrus calleryana cvs</td>
<td>Autumn Blaze callery pear</td>
<td>30’ – 25’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pyrus calleryana cvs</td>
<td>Chanticleer callery pear</td>
<td>40’ – 15’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
**TABLE 14-1**  
Approved Street Tree List

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Mature Height/Width</th>
<th>Water Requirement</th>
<th>Minimum Planter Width</th>
<th>Grow Under OH Wires</th>
<th>City Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pyrus calleryana cvs</em></td>
<td>Redspire, callery pear</td>
<td>35’ – 20’</td>
<td>Low</td>
<td>6 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Quercus macrocarpa</em></td>
<td>Burr Oak</td>
<td>60’ – 50’</td>
<td>Medium</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Quercus rubra</em></td>
<td>Red Oak</td>
<td>75’ – 50’</td>
<td>Medium</td>
<td>12 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Tilia cordata</em></td>
<td>Greenspire, littleleaf linden</td>
<td>35’ – 25’</td>
<td>Medium</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Tilia cordata</em></td>
<td>Summer Sprite, littleleaf linden</td>
<td>20’ – 15’</td>
<td>Medium</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditional&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Sorbus acuparia</em></td>
<td>Variety</td>
<td>35’ – 30’</td>
<td>Medium</td>
<td>8 feet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Syringa reticulate</em></td>
<td>Ivory silk</td>
<td>20’ – 10’</td>
<td>Low</td>
<td>4 feet</td>
<td>Yes</td>
<td>Conditional&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Low water requirements: Generally able to survive with minimal water after a 2-year establishment period or supplemental water in times of extended drought. Plants should not require more than 5 gallons per square foot during a season of 25 weeks.

Medium water requirements: Plants listed as needing “Medium Water” will likely require 12 to 15 gallons per square foot during a season of 25 weeks.

<sup>a</sup>Conditional approval: Even though the sizes of these tree species are appropriate for the distance under overhead utility lines, the City reserves the right to review each circumstance.

### 12.3.9 Turf, Sod, or Grass Seeding

Turf is discouraged in public right-of-way projects, but will be assessed by the City of Bend on a case-by-case basis. The City encourages the use of ground covers or ornamental grasses in place of turf and sod whenever possible.

Turf, sod, or grass seeding of cool season grass species shall be prohibited on slopes greater than 25 percent, or in areas where any dimension is less than 10-feet. Re-vegetation with annual plant species, used for erosion control purposes, shall be considered by the City Engineer on a case-by-case basis. Any seeding will be established during seasonally appropriate periods for each species and irrigated using temporary irrigation.

Turf-type tall fescue seed or sod shall be selected from specified suppliers as stated in the Special Provisions of the City of Bend Standards and Specifications. Seed mixtures shall be of at least three varieties of approved species.

### 12.3.10 Minimum Tree Location Standards

#### 12.3.10.1 General

- **Minimum planting distance from public sidewalks:** Trees shall be centered between the curb and the public sidewalk, within the planting strip, whenever possible. If the trees cannot be centered because of unforeseen site conditions, or because the landscape design requires it, then the trees shall not be located
less than 3-feet from either the curb edge or the sidewalk edge for small and medium trees and 4-feet for large specimens trees.

- **Minimum distance from vehicular, bike, and pedestrian traffic:** Trees shall be placed to prevent contact or visual obstructions between the plant’s structure and vehicles, bicyclists, and pedestrians. Trees shall not be planted within Clear Vision Areas as defined in the Development Code or within Intersection/Decision Sight Triangles discussed in Design Standards Section 4.3. This applies to center medians as well as roadside areas.

- **Minimum distance for shrubs, ornamental grasses, and ground covers:** Plant materials that potentially could grow above 18-inches in height or higher shall be located a minimum of 3-feet or more from the sidewalk and curb edges, depending on the species’ overall characteristics.

- **Minimum width of median allowable for trees:** Trees shall not be planted in medians less than 4-feet wide, as per the Oregon Department of Transportation (ODOT) “Guidelines for Planting within Highway Right-of-Way.”

- **Exemptions:** The City of Bend will consider waiving the tree and plant location standards on a case-by-case basis if special conditions warrant an exception.

- **Stormwater:** Trees placed within a stormwater facility should be planted towards the side so that the rootball does not interfere with drainage down the center.

### 12.3.10.2 Minimum Clearances for Street Trees

On public right-of-way landscape projects without existing sidewalks, trees shall be located to accommodate future sidewalk locations with consideration for existing and future utility corridors. Trees or plants that will attain a mature height greater than 18 inches shall not be planted within the Clear Vision Area (see Standard Detail R-2), or Intersection/Decision Sight Triangles discussed in Design Standards Part II, Section 2-3.3.4.3.

(see Standard Drawing R-2) for intersection right-of-way site distances. The minimum planting clearances shown in Table 14-2, Minimum Clearances for Street Trees, shall be followed require extended distances and alterations when the road curves, changes grade, or other project-specific impediments to clear vision standards, intersection sight triangles, and intersection sight distances exist.
### TABLE 14-2
Minimum Clearances from Site Features

<table>
<thead>
<tr>
<th>Site Features</th>
<th>Minimum Distance from Site Feature by Tree Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small (up to 25-foot Height)</td>
</tr>
<tr>
<td>Intersections</td>
<td>30 feet</td>
</tr>
<tr>
<td>Driveways</td>
<td>5 feet</td>
</tr>
<tr>
<td>Alley access</td>
<td>15 feet</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>3 feet</td>
</tr>
<tr>
<td>Fire hydrants</td>
<td>5 feet</td>
</tr>
<tr>
<td>Water meters</td>
<td>5 feet</td>
</tr>
<tr>
<td>Utility boxes</td>
<td>5 feet</td>
</tr>
<tr>
<td>Utility poles</td>
<td>10 feet</td>
</tr>
<tr>
<td>Street lights</td>
<td>15 feet</td>
</tr>
<tr>
<td>Stop signs</td>
<td>35 feet or more</td>
</tr>
<tr>
<td>Regulatory signs</td>
<td>Do not block</td>
</tr>
</tbody>
</table>

### 12.3.10.3 Minimum Clearances for Utilities
The following standards apply to the planting of trees near existing or proposed utilities.

#### 12.3.10.3.1 Overhead Utilities
Only trees, 25-feet high or less, at maturity, shall be considered for planting under or within 10-lateral feet of any overhead utility lines.

#### 12.3.10.3.2 Underground Utilities
All trees shall be planted outside of any utility easement unless written approval is obtained from the applicable agency. No tree will be approved for planting within the easement that contains a City water or sewer main unless approved by the City Engineer.

### 12.3.11 Street Tree Spacing Standards

#### 12.3.11.1 Intersections
Street trees shall be a minimum caliper of 2-1/2-inches DBH (or 4 feet above the ground), as stated in the Bend Code, Chapter 10-10. Street trees shall not be placed within the Clear Vision Standards, Intersection Sight Triangles, and Intersection Sight Distances (see Standard Drawing R-2) approaching a street intersection.

A street tree located within or near the Clear Vision Standards, Intersection Sight Triangles, and Intersection Sight Distances exiting an intersection shall be 2 1/2-inch caliper or greater with the lowest branches above 8-foot head height when installed. See Table 14-1 for particular species and varieties that are acceptable, and also the Bend Code, Chapter 10-10.
12.3.11.2 Streets
Street tree spacing shall be based on the type of tree(s) selected and the overall canopy size at maturity.

<table>
<thead>
<tr>
<th>Tree Type</th>
<th>Size at Maturity</th>
<th>Minimum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small canopy trees</td>
<td>(up to 25 feet tall)</td>
<td>up to 30 feet apart</td>
</tr>
<tr>
<td>Columnar tree varieties</td>
<td>(vertical height variable) 10 feet to 20 feet wide</td>
<td>up to 30 feet apart</td>
</tr>
<tr>
<td>Medium canopy trees</td>
<td>(up to 45 feet tall/ wide)</td>
<td>up to 40 feet apart</td>
</tr>
<tr>
<td>Large canopy trees</td>
<td>(up to 80 feet tall/ 50 wide)</td>
<td>40 feet</td>
</tr>
</tbody>
</table>

Spacing required may vary depending on site and/or topographic constraints.

A random placement of street trees may be approved in certain circumstances. An equivalent number of trees are required for the length of street frontage. For design flexibility, trees may be grouped together; however, trees shall be placed no closer than 80 percent of the average mature width of the trees. See example below.

Example:

\[
\frac{40 \text{ ft. wide tree} + 15 \text{ ft. wide tree}}{2 \text{ trees}} \times 0.8 = 22 \text{ feet minimum spacing between the two trees}
\]

12.4 Standard Materials and Equipment

12.4.1 General
Designs shall incorporate materials and equipment that comply with the City of Bend Standards and Specifications. Alternative materials shall only be used when an approved Deviation from Standards and Specifications request has been submitted and approved.

12.4.2 Tree Wells
Street trees planted within sidewalk tree wells shall provide a tree grate or permeable pavers. The minimum tree pit dimensions shall be 36-square feet (6 ft x 6 ft).

12.4.3 Soil Amendments
The City of Bend encourages the use of soil amendments to improve soil structure and increase aeration, water penetration, and water retention for plant hydration when appropriate for the selected plant species. Soils shall have 3 inches of soil amendments for lawn and groundcover areas tilled to a depth of 6 inches. Spot amendments for individual trees and shrubs should be 1/3rd of the hole size dug for the planting. Native shrub zones shall not be planted in amended soil.

The landscape plan shall clearly mark or note areas that should remain un-amended for native shrub vegetation plantings.

12.4.4 Mulches
Organic mulch such as shredded bark or bark compost shall be applied to all planting areas for moisture retention, weed control, and moderation of soil temperatures. Impermeable weed barriers made of plastic are prohibited under any mulches because
they restrict air and water circulation to root zones and cause a drainage impediment. Woven geotextile products will be allowed under gravel or rock mulches with City approval. Gravel or rock mulches will be considered on a case-by-case basis as part of the landscape plan approval. If gravel or rock mulches are approved, they must be natural colors with no unnatural applied patterns.

The landscape plan shall identify the proposed type and recommended depth of installation for all proposed mulch materials. Follow the recommendations as proscribed in Bend Standards and Specifications, ‘Mulch’, unless a substitute material has been approved by the Planning Director prior to installation.

12.4.5 Fertilizers

The landscape plan shall specify any additional requirements that may be necessary for fertilization that would be advisable for particular site conditions that may exist for the establishment of new plant material. A soils test shall be employed to determine the requirement for fertilizers, what kind/concentration and how much should be distributed. The industry standard commercial type fertilizer is recommended for grass, with 100 percent of the elements derived from organic sources, in proportion necessary to eliminate deficiencies of nutrients.

The landscape plan shall specify type and recommended application rate for each proposed use of any fertilizer recommendation that deviates from the Bend Standards and Specifications, Section 10130-Seeding, and Section, 01040-Planting, for approval by the City.

12.5 Landscape Plan Submittals

12.5.1 General

Applicants for construction approval involving any public development where streetscaping or landscaping improvements within the public right-of-way are a part of the improvement, either new or existing, shall submit a Landscape Plan in compliance with these standards and those set forth in other Bend codes. Following the review, the plans shall be returned either approved as-is, or with required modifications noted. Subsequent submittals may be required or a deviation and detail standard deviation process to the existing standards requested prior to “notice to proceed” approval.

See Part 2, Section 2, Design Submittal Requirements, Section Landscaping and Irrigation Plans, for plan submittal requirements and City of Bend CAD Standards.

12.6 Irrigation

12.6.1 General

The irrigation system shall be designed to be efficient and to uniformly distribute water. Specific criteria that shall be considered in the design include soil type, slope, root depth, plant materials, hydrozones, weather conditions, water source (for example, quantity, quality, and pressure), peak demand, and watering windows.

To conserve and protect water resources, the Irrigation Designer shall select appropriate equipment and components that meet the City of Bend Codes, Standards and Specifications. The City requires EPA WaterSense labeled smart irrigation controllers that automatically adjust irrigation in response to environmental conditions to promote water conservation in all public right-of-way projects. The Landscape Architect/Irrigation
Designer should strive to design projects that are aesthetically pleasing, conserve resources, and diminish long-term maintenance by City staff.

Drip irrigation is highly desirable wherever practical. (This may preclude the use of turf in many designs unless using alternate irrigation methods other than spray heads). Drip irrigation should be employed where dimensions are less than six feet in any direction. Overhead irrigation in areas greater than six feet in dimension should utilize low-precipitation rate sprinkler nozzles and have a precipitation rate of less than 1.0 inches per hour.

For capital improvement and development projects, the following design requirements shall be implemented in all design deliverables and submittals presented to the City of Bend for review.

12.7 Design Parameters

The irrigation system shall be designed based on the accompanying landscape plan. The minimum supply water pressure shall be based on information supplied by the water utility, field-verified and noted on the drawings.

Irrigation systems shall be designed with consideration for existing and proposed site-specific topography, soils, site orientation, prevailing wind conditions, and micro-climates to eliminate the possibility of run-off and overspray, minimize evaporation, and increase the rate of infiltration.

Different irrigation methods must be separated to prevent over-watering or under-watering. Sprinklers, bubblers, microsprays, drip, and subsurface irrigation must be operated separately.

Provide separate irrigation zones to irrigate trees separately from ground covers, shrubs, and turf.

Pop-up spray irrigation is prohibited for watering trees and shrubs in areas less than six feet in dimension in any direction. Spray irrigation may be used for "temporary irrigation zones" and is required for any areas being revegetated with drought-tolerant and native plant species. Temporary irrigation systems shall be reviewed on a case-by-case basis and removed after the vegetation is established. Landscape and irrigation plans shall identify location, number of zones, and irrigation types proposed for any areas determined to be temporary irrigation zones.

Spray irrigation with a precipitation rate greater than 1 inch per hour is prohibited.

Separate zones are required for permanent and temporary irrigation lines.

12.7.1 Safety

Run-off and/or over-spray from sprinkler heads shall be eliminated from streets and sidewalks by use of proper design principles and installation practices.

To conserve and protect water quality, all landscapes and irrigation installations shall consider the safety of resources, and protect native habitats and watersheds.

The irrigation design shall consider the City maintenance staff and the safety of maintaining the landscape and irrigation by selecting products that require the least amount of service, repair, and replacement, and locating buried vaults and valves at locations where proximity to traffic is minimized.
12.7.2 Hydrozones

The irrigation plan, in conjunction with the landscape plan, shall prevent over-watering and under-watering by implementing the principles of ‘matched hydrozones’; that is, grouping and watering plants based on their water needs. Separate valves shall be assigned to plant groups with widely different needs:

- "VERY LOW" irrigation needs: separate native plants needing water for establishment and minimal to no supplemental water thereafter.

- "LOW" irrigation needs: separate xeric or high-desert-adapted plants needing low water through growing season from non-high-desert-adapted plants

- "MEDIUM" irrigation needs: separate medium and large tree species from shrubs and groundcovers. These plants will require moderate and regularly spaced irrigation through growing season. (Shrubs and groundcovers grown under trees may be an exception in that the entire area is being watered together.)

- "HIGH" irrigation needs: separate turf/sod areas and other ornamental plant species that need regular, heavy water through growing season.

In addition, the following site-specific situations shall be considered for separating zones:

- Separate valves/zones for planting areas that have soil types that are significantly different as a result of being amended or disturbed.

- Separate valves/zones for plants in "planters," containers, tree wells, tree pits, or other limited spaces because those spaces dry out faster.

- Separate valves/zones for plants on slopes, because they may require several short cycles to prevent runoff.

- Separate valves/zones for landscape areas separated by physical barriers such as walls, fences, roads, sidewalks and driveways.

12.7.3 Hydraulic Calculations

Irrigation schematic designs shall supply the complete calculations for all irrigation zones (drip zones and spray zones separately). Start from the Point of Connection, using a step-down method with flow and loss at each piece of equipment with length of pipe run between each piece of equipment. Supply a table showing the total water required for each zone and the total for all zones to ensure that the design has not exceeded the maximum for the meter, proposed pipe size, and zone watering times.
An example is provided below:

<table>
<thead>
<tr>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>Zone 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Pop-up spray</td>
<td>Pop-up spray</td>
<td>Pop-up Spray</td>
<td>Drip</td>
</tr>
<tr>
<td>Maximum flow (gallons per minute)</td>
<td>19.4</td>
<td>19</td>
<td>19.8</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total Water Required for all (5) Zones: = 70.2 gpm**

**Meter flow rate is 20 gpm**

### 12.7.4 Drip Irrigation Design

#### 12.7.4.1 General

Drip irrigation shall be used where dimensions are less than six feet in any direction. Overhead irrigation in areas greater than six feet in dimension shall utilize low-precipitation rate sprinkler nozzles and have a precipitation rate of less than 1.0 inches per hour.

The drip irrigation system shall be designed according to standards and engineering practices specified by the American Society of Agricultural Engineers (ASAE).

The irrigation system should be designed to meet the changing water requirements of the landscape and the expansion of root zones as plantings mature.

#### 12.7.4.2 Uniformity

Drip irrigation systems shall be designed so that the drip emitters have an ‘Emission Uniformity’ (relative flow rate between like emitters) of at least 80 percent at time of installation. The following guidelines will ensure good uniformity:

Install pressure regulator with filter and pressure regulating emitters for irrigation laterals that cover terrain with elevation changes greater than 5-feet.

Pipe shall be sized so there is no more than a 20 percent drop in water pressure, from the beginning to the end of the lateral, under peak flow. Pipe shall be sized so the flow velocity within the pipe is less than 5-feet per second to minimize excessive velocity and friction loss.

Systems that are operated from ‘hard water’ sources shall not use orifice or vortex type emitters, or emitters with rigid internal parts, because of high incidences of mineral buildup and plugging.
12.8 Standard Materials and Equipment

12.8.1 General
Designs shall incorporate materials and equipment that comply with City of Bend Standard Specifications and OSS for Irrigation Systems, Section 01120. Alternative materials shall only be used when an approved Deviation from Standards and Specifications request has been submitted and approved.

Materials shall be designated by trade name as per City of Bend Special Provisions or an approved equal, as verified from information in the manufacturer’s catalogue and shown to contain comparable components.

12.8.2 Irrigation Controllers
The City of Bend uses the current technology for programming and monitoring irrigation systems for landscape areas within the city, to ensure the most efficient delivery of water to the public right-of-way. Irrigation controllers shall be EPA WaterSense labeled smart controllers that automatically adjust irrigation run times in response to environmental conditions.

12.8.3 Automatic Control Valves
Automatic electric solenoid remote control valves shall be slow acting diaphragm-type, as per Bend Standards and Specifications, 01120.17 Valves (h) Control Valves, (2) Automatic Control Valves.

12.8.4 Sprinkler Heads
Sprinkler heads shall provide coverage as specified in the manufacturer’s design literature. Pop up sprinkler heads shall utilize low-precipitation rate nozzles. Precipitation rates for individual irrigation zones shall be less than 1 inch per hour.

12.8.5 Pipe
Right-of-way projects shall be entirely furnished with one pipe class or schedule type, (such as Schedule 80-PVC), as per the Bend Standards and Specifications, and conforming to all other national and local standards.

12.8.6 Blowouts
A blowout connection point shall be installed to facilitate winterization by use of compressed air. Locate blowout connection immediately downstream from backflow device.

12.8.7 Crossings Under City of Bend Streets

12.9 Irrigation Plan Submittals

12.9.1 General
An irrigation schematic plan shall accompany the landscape plan that identifies the location, type, and coverage of sprinklers, drip lines, valves, zones, point of connection and equipment required to provide water as prescribed by the City of Bend as part of the
submittal to the City for review and approval prior to installation. An irrigation plan is required for any public development where streetscaping or landscaping within the City of Bend right-of way is part of the improvements, either new or existing. The irrigation plans shall be in compliance with these standards and those set forth in OSS and in other Bend Codes, Standards, and Specifications.

See Chapter 2 for plan submittal requirements and City of Bend CAD Standards.