Institute for Environmental Solutions

761 Newport Street,
Denver, CO 80220-5554

Phone: 303-388-5211
Fax: 303-388-3209
www.I4ES.org

The Tree Project:

Integrated Urban Environmental Improvement Through Tree Selection and Management

Phase 1 Report

January 2007

APPENDIX C
Colorado Tree Ordinance Guide

The Tree Project: Phase 1 Report

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Colorado Tree Ordinance Guide

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Prepared by: Desirée Thorp

Executive Summary

The Tree Project goal: "To identify how trees can be used to optimize energy and water conservation and air quality."

To reach this goal and ensure that the Tree Project would abide by local regulations, the Institute for Environmental Solutions conducted a survey of ordinances from a representative sample group of Front Range communities – communities where rapid urban development is taking place east of the Rocky Mountains of Colorado. The cities surveyed were Denver, Aurora, Boulder, Westminster, Fort Collins, and Castle Rock. Ultimately, the findings of The IES Tree Project should be incorporated into communities' ordinances to foster improved environmental quality.

IES first produced a summary of each city's regulations which extrapolates any rule or recommendation that would have an effect on The Tree Project. Next, in order to compare one ordinance's elements to the next, two spreadsheets were created.

The first spreadsheet compares recommended tree species and their water needs and catalogs more than 250 species including:

- Which species are frequently recommended and by whom
- Which species are not recommended or prohibited
- What supplemental water each tree could require

The tree species recommended by the municipalities are also compared to species recommended by other institutions whose operations involve trees or whose services benefit from trees including Denver Water, Colorado State University's Cooperative Extension, the Colorado State Forest Service (Keith Wood), and Xcel Energy. An inventory of the most popularly recommended trees will assist The IES Tree Project in choosing trees that are well-suited for the Front Range, are popular among foresters and city governments, and are potentially optimal for environmental benefits.

The most commonly recommended trees include:

Tatarian Maple	Amur Maple
Golden Rain Tree	Bigtooth or Wasatch Maple
Swamp White Oak	Common Hackberry
Bur Oak	Kentucky Coffeetree
Ohio Buckeye	Japanese Tree Lilac
Common Horsechestnut	English Oak

The second spreadsheet lists the technical aspects of each ordinance and highlights its variation. It presents:

- Goal(s) for municipalities respective to landscaping regulations
- Commitment to tree protection

- Dedication to the environment and water conservation measures
- Commitment (or lack thereof) to water-wise landscape methods

Many cities have multiple documents that refer to regulations, guidelines, and standards concerning trees that may or may not be enforceable by law. For example, Denver has The Streetscape Design Manual, the Denver Forestry web site, and its municipal ordinances.

Communities such as Aurora and Castle Rock, which have limited water supplies, require the use of xeric plants and trees and limit the amount of turf that can be installed. Denver and Boulder suggest the selection of drought-tolerant species, but do not require it. The table below compares the main aspects of each city's ordinance.

Elements	Denver	Aurora	Westminster	Fort Collins	Boulder	Castle Rock
Main Goal	Legacy	Water conservation	Sustainability	Sustainability	Continuity	Water conservation
Last updated	1993	2005	2004	2001	2006	2003
Xeric design or hydrozones	No	Yes	Yes	Yes	No	Yes
Protection	Yes	Yes	Yes	Yes	Yes	NA
Minimum size	Yes	No	No	Yes	No	Yes
Unique trees	No	No	Yes	No	No	Yes

Most of the municipalities take a similar approach to their landscaping goals. However, Castle Rock goes beyond seeing its regulations as rules to be followed, and defines them as principles of consumption to be instilled into the community.

Conclusions

The IES Tree Project survey of six Front Range communities' ordinances found the following:

- Half of the communities surveyed emphasize the necessity to conserve water through the use of endemic plants and trees.
- The majority of tree selection criteria is governed by a tree's mature height and spread, its distance from utilities, buildings, and other trees, whether it produces fruit and/or thorns, species diversity requirements, and potential sight obstructions.
- Half of the municipalities did not recommend any particular trees for their drought tolerance, low-water consumption or potential contributions to the green urban infrastructure.
- Most regulations govern trees solely in the public right-of-way, called street trees.
- Maintenance is mentioned in all of the ordinances, but proper watering and tree care practices are vaguely suggested rather than outlined in detail.
- Castle Rock and Denver request that trees planted be large enough to provide shade immediately.

- Denver and Boulder are the only two cities surveyed that do not require the use of select xeriscape principles.

The IES Tree Project conducted a survey of six Front Range communities' ordinances concerning trees for two reasons. First, IES wanted to implement The Tree Project with knowledge of existing ordinances and gaps within those ordinances. Second, IES plans to incorporate recommendations stemming from the scientific phase of The Tree Project into municipalities' ordinances in order to address environmental problems as well as public safety and other issues already embodied in the documents. IES will create a model ordinance for Front Range communities. Identification of 'model environmental' aspects of each of the six ordinances surveyed are outlined at the end of each municipality's summary.

The City and County Denver: Guidelines and Standards for Tree Planting and Selection

Denver is the capital of Colorado with a population of more than 554,000 (City and County of Denver 2006). Several resources are available concerning tree ordinances and standards for the City and County of Denver; the three main sources in order of relevance to The IES Tree Project are 1. The Streetscape Design Manual (The Manual) which can be accessed online at http://www.denvergov.org/admin/template3/forms/Streetscape.pdf; 2. The Denver Forestry web site, http://www.denvergov.org/Forestry/default.asp; and 3. The Municipal Code for the City and County at http://www.municode.com/resources/gateway.asp?pid=10257&sid=6.

The Streetscape Design Manual is used mainly by landscape architects and urban planners to design site plans. The Denver Forestry web site describes the Parks and Recreation Department's activities and contains informational pages for residents on how to care for their trees. The Municipal Code governs the City Forester position and administrative procedures of Denver's forestry activities.

The three resources governing tree selection, planting, and maintenance in Colorado vary significantly and create confusion as to the city's priorities and required standards. The Streetscape Design Manual is the most widely used by landscape architects and is also the most relevant to The Tree Project. While all of the documents recommend selecting trees that have lower water requirements, it is not a standard to which developers must adhere. Other considerations are given more importance such as continuity of community design and tree size relative to its surroundings. Xeric landscaping techniques and principles are not mentioned in the Streetscape Design Manual, but Denver Forestry refers to them briefly. This overview will outline the goals of each resource and the relevant guidelines and will summarize their respective recommendations.

1. The Streetscape Design Manual

After a brief introduction that emphasizes the legacy of Denver's park system, The Manual states its main purpose: "to make the city's guidelines for design of streets clear… [The Manual] is a tool for expanding the legacy of beautiful streets in Denver."

The Manual also underlines the importance of maintaining the character of the city's neighborhoods in which the work proposed is being done and to consider whether or not there are overall development plans already underway that would apply to the new design to ensure unity and consistency of style.

The design recommendations start off with street tree guidelines recognizing that trees supply several benefits including shade, wind buffering, cleaning the air of pollutants, and reducing sun glare. The Manual does not list other important benefits that IES has identified such as stormwater control and quality, reducing energy consumption, carbon sequestration, community health, etc. Denver looks to street trees as providing a buffer between traffic and pedestrians while making the sidewalk a more welcoming and comfortable place for pedestrians.

The five sub-headings for the street tree guidelines are Design, Recommended Street Trees, Trees Allowed, Trees Not Allowed, and Special Use and Small Street Trees. The Manual includes guidelines and standards, to which developers are expected to adhere. Standards are identified with underlining.

Design

"Design for street trees should respond to the uses on the street." Most of the design guidelines govern where to plant trees in a tree lawn or sidewalk, how to space them, recommended size, sight-view considerations for intersections, and protecting trees from damage during construction. The general guidelines taken from The Manual include:

1. Trees should have the same characteristics on both sides of the street. If mixing species, alternate them in a regular pattern.
2. Plant only one species where an area is to be unified. Avoid random changes in species.
3. Select trees that will fit when they are mature. Narrow areas suggest a narrow tree, and open areas suggest a wide one.
4. Where tree lawns do not exist, tree grates or pavers are recommended to protect tree roots and pedestrians. Ground covers may be considered in low traffic volume areas.
5. Use tree grates where pedestrian traffic volume is high.
6. Existing trees must be protected during construction. For projects where a number of existing trees need protection, develop a tree protection program and have it approved by the City Forester. Consult the City Forester prior to removing any trees from the right-of-way.
7. A permit is required from the City Forester prior to planting trees in the right-of-way.

The following guidelines and standards concern the placement and spacing of trees for public safety.

1. Plant trees with regular spacing in straight rows to create a continuous street edge. Adjust spacing only slightly for driveways and lights.
2. Locate trees in a straight line midway between the curb and detached walk even where the width of the tree lawn varies.
3. Plant trees 30-45 feet (from center) for most species. Reduced spacing may be appropriate depending on the space and species. Review special conditions with the City Forester.
4. When replacing trees in an existing row, select new trees of similar characteristics to those being replaced, including form, scale, texture, and color.
5. Trees should not be planted closer than 30 feet from the curb face at intersections and street corners within the corner triangle. Review the Transportation Division to determine specific requirements.
6. Within the sight triangle, no non-plant materials over 32 inches or plant materials over 6 inches high are permitted except for deciduous trees, traffic control, and lighting devices.

7. Maintain minimum sight triangle and corner triangle distances for safe view of oncoming traffic and pedestrians.
8. Trees must not interfere with visibility of traffic control devices especially at intersections. Review with the Transportation Division to determine specific requirements.
9. At alleys, trees should not be located closer than 10 feet from the projected alley property line.
10. Trees should be located a minimum of 42 inches from the face of curb.
11. For commercial and residential streets, the minimum distance from street lights is 20 feet for most trees. Individual species and site conditions may warrant a variance if approved by the City Forester, streetlighting design – Transportation Engineering, and Public Service Company.
12. At all locations trees should be adjusted slightly to ensure the driver's visibility of regulatory signs.
13. Create a clear walking zone between trees and buildings. In downtown, 10 feet is minimum. Distances as low as 5 feet may be possible where space is very limited, however few tree species will be appropriate in such a small area. Trees must be placed far enough away from buildings to allow them to grow without excessive pruning.

The following guidelines and standards concern the tree size and branch height.

1. Street trees in grates should be 3 inch caliper, minimum, with high branching where pedestrians will be passing beneath the tree canopy. This size is recommended so that adequate branching height is achievable without severe pruning.
2. Trees in tree lawns should be 2 inch caliper, minimum. Note that under the favorable conditions of a tree lawn, this smaller size tree may soon catch up to the growth rate of a larger tree planted in a grate (emphasis added).
3. The branching height of mature trees on the traffic side of the street should be no less than 13 feet 6 inches above the street.
4. The branching height of mature trees on the pedestrian side of the street should be no less than 8 feet above the sidewalk.
5. Small varieties of thornless and fruitless trees may be used only in median areas or traffic islands where lower branching habit will not interfere with pedestrians, vehicles, or driver visibility.
6. Trees within the small street tree category should only be used where power lines overhead would not allow a large street tree to reach maturity without severe pruning.

The last part of this section is entitled "Tree Selection" and addresses climate concerns. The Manual recommends that "all trees should fit the microclimate, soils, sun, moisture, budget, and maintenance environment in which they are planted." However, rather than being overly concerned with water consumption and conservation, Denver county mentions that the trees should be "able to endure pollution, compacted soils, minimal water, and low maintenance." The Manual recommends that street trees in commercial districts have an irrigation system that minimizes water waste.

1. Trees near walks should be thornless and fruitless to minimize maintenance and to reduce pedestrian hazards. They must be strong-wooded, resistant to most diseases and insects, single-trunked, with upright growth, and a medium-to-long life expectancy. Branches should resist breaking.
2. Tree and irrigation techniques that require minimal water should be considered. Irrigation must be installed for street trees in all commercial streets. Irrigation must be designed to deliver the appropriate amount of water to each tree with minimum waste (emphasis added). Easily adjustable, automatic irrigation controls are recommended.
3. Along commercial streets, trees should be selected that will minimize the obstruction of view to retail signs. Employ trees with appropriate forms and character. Utilize tree spacing which supports this concept.

Recommended Street Trees

The City and County of Denver recommends certain trees based on their "dependability, low maintenance, and drought resistance." See Appendix A for the species recommended by each municipality.

Trees Allowed

The City and County states that trees beside those listed above may be approved in certain situations upon consultation with the City Forester.

Trees Not Allowed

Some types of trees are prohibited from being planted in the right-of-way unless they are approved by the City Forester.

Special Use and Small Street Trees

While not recommended for street trees, special use and small trees are referred to for use in medians, neighborhood entry marker plantings, and locations where a big tree would not work well such as near power lines and signage.

Many of Denver's unique neighborhoods have specific guidelines of their own, which otherwise defer to The Manual. Most offer a general statement about the neighborhood's intended look with regards to trees; however there are a few notable exceptions which are listed below. Common guidelines among communities are listed here:

- Overall site landscaping shall include not less than one tree per 40 linear feet or zone lot frontage and at least one tree and ten shrubs, or a combination of trees and shrubs per 600 square feet.
- Such trees shall be spaced evenly and coordinated with the spacing of street trees in the adjacent public right-of-way.
- Required landscaping shall meet the following minimum size requirements:
  Deciduous trees 2 inch caliper

Ornamental trees	1-1/2 inch caliper
Evergreen trees	5 feet tall
Shrubs	5 gallon container
Vines and perennials	1 gallon container

Denver Gateway

Intent: "To soften and mitigate the visual impacts of large buildings and expansive paved areas in the context of the open prairie landscape."

- Requires that trees be planted along all public streets
- Stresses continuity
- Recommends that water conserving planting design and irrigation practices be employed

Stapleton

Intent: "To promote quality in landscape design, compatibility between lots, mitigation of the impacts of large buildings and paved areas, water conservation, and a well-maintained appearance."

- Recommends that landscaping should be one of three categories: landscaped and irrigated, low water landscaped, or native landscaping within drainage areas.

LoDo

Intent: "Trees are significant elements which can unify a commercial street's appearance. Moreover, formal repetitive use of trees creates a space which is scaled to the pedestrian at the level of the retail façade."

- Trees selected should be resistant to diseases and insects, require little maintenance, be single-trunked and upright, produce little fruit or seeds, have deep roots and strong branches, and long lived.
- "Trees planted in the public right-of-way …should be large enough at the time of planting to add substantial greenery and shade to the street."
- Street trees are recommended to be 3 inch caliper minimum.
- Trees on the same street or block should be of the same species or at least similar in height and shape.
- Branch height on the traffic side should be at least 12 feet and on the pedestrian side at least 8 feet high.
- The tree's mature size and shape should be considered when selecting a location.
- Tree trunks should make a straight line along the street even if the width of the walkway varies.
- Trees should be placed at least 25 feet from the nearest utility pole or street light.

2. Denver Forestry

Denver Forestry's web site is another resource that provides guidelines for selecting, planting, and caring for trees in Denver. Denver Forestry is responsible for managing trees in or surrounding public parks, parkways, public office buildings, the city's nursery, planting trees,

overseeing tree maintenance in the public right-of-way, and assisting citizens with arboricultural issues. Denver Forestry is a branch of the Parks Division of the Parks and Recreation Department.

The Forestry's web site includes two ordinances; one is entitled Trees and Shrubs, and the other is entitled Tree Retention and Protection. The Trees and Shrubs ordinance covers tree planting permits, tree quality assurance, delivery, storage, handling, planting conditions, warranties, maintenance during construction, mulching, soil, water, weed control, excavation, clean up, disposal of waste, and protection. The Tree Retention and Protection ordinance includes general requirements, tree protection, construction of paved surfaces, irrigation and utility installation, root pruning, fencing, signage, monitoring, injuries or damage penalties, and maintenance after completion of project.

Regarding trees, Denver Forestry states that

- Only plants grown and harvested from hardiness zones 2, 3, 4, and 5 will be acceptable.
- Branch height should one-third to one-half of tree height.
- Trees of one species shall be culturally uniform, or matched in height, crown width and shape, height-to-first branch, and trunk taper.

Denver Forestry and the City and County of Denver prepared a street tree brochure to help homeowners decide how, where, and when to plant a tree including planting techniques. The brochure emphasized that the following trees should not be planted in the right-of-way:

- Siberian Elms
- Willows
- Russian Olive
- Box Elders
- Poplars
- Evergreens
- Weeping trees
- Trees that produce fleshy fruit
- Multi-stemmed trees

These spacing requirements are stated in the brochure:

35 feet between shade trees
25 feet between ornamental trees
30 feet from curb at intersections
20 feet from street lights
10 feet from alley, driveways, and fire hydrants
7 feet from attached sidewalks

Denver Forestry also lists xeric native trees and their mature height.

Lastly, Denver Forestry has several pages on how to recognize drought stress in trees, plant a tree during a drought, help your trees survive a drought, water your trees during a drought, and prune storm-damaged trees.

3. The City and County Denver Municipal Code

The Municipal Code for the City and County of Denver outlines proper maintenance of trees, the permitting process for planting, and tree protection during construction, and public safety issues?.

Article II of the municipal code outlines the City Forester's role and states who has responsibility under what circumstances.

Sec. 57-18 states that the City Forester, through the Parks and Recreation Manager, is responsible for maintenance of trees on the public right-of-way or in other public places and that the responsible party of property abutting the public right-of-way has the duty of maintaining trees located in the abutting public right-of-way.

Sec. 57-19 states that the Parks and Recreation Manager establishes the rules regarding planting and maintenance of trees including spacing requirements, the types of trees permitted, and maintenance and removal procedures in the public right-of-way.

Sec. 57-20 states that it is unlawful to plant or remove trees from the public right-of-way without first obtaining a permit issued by the City Forester.

Sec. 57-21 states that the responsible party shall remove dead, dying, or structurally unsound limbs when they pose a threat to life, limb, or property.

Sec. 57-22 states that the City Forester can inspect any trees in the public right-of-way and will notify the responsible party of the condition of the tree and necessary action in case of disease.

Sec. 57-23 states that the responsible party shall maintain trees abutting said property to keep them from interfering with walkways, streets, alleys, and other public places. If a tree is interfering, the City Forester will issue an order to remove the obstruction.

Sec. 57-24 states that it is unlawful to injure, damage, or remove trees on public property. In the case of injury, damage, or removal, the City Forester should be notified, and the responsible party will be held accountable for compensation to the City and County.

Sec. 57-25 states that certain trees will be granted a permit for removal on residential properties if the tree is irreparably damaged, diseased, dying, or dead, if the tree poses a threat to public health and safety, if the tree is an undesirable or nuisance species, or if the preservation of the tree would hinder development.

Sec 57-26 states that it is unlawful to climb, attach lumber, fabric, wire, nails, bolts, cables, ropes, or any other foreign material to the natural growth of a tree.

Sec 57-71 states that it shall be unlawful for any person to engage in the business of planting, cutting, trimming, pruning, or removing trees, shrubs, or vines without first procuring a license from the Excise and Licenses Director.

Sec 59-80 states that existing mature tree growth and natural land forms on the site shall be preserved to the maximum extent possible.

Sec 59-347
(d) states general goals of the City's landscaping. Landscape features and materials will enhance Denver's image as a green city, help conserve water, emphasize the importance of public streets, parks, and open spaces, protect environmental conditions and microclimate, improve the appearance and value of property, buffer land uses or buildings that differ significantly in scale or type, and preserve existing stands of mature trees.
(4) states that all stands of five or more living trees with a caliper of 4 inches or more that are not diseased or decayed shall be preserved. Decayed or diseased trees shall be removed to protect remaining trees.

Model Ordinances – City and County of Denver

I. Trees…supply shade …and help clean the air…

A. …same species should be planted on a block.
Select trees that will fit when they are mature.
Existing trees must be protected during construction.
Trees should be large enough when planted to add substantial shade and to reach a height appropriate to surrounding buildings.
Note that under the favorable condition of a tree lawn, this smaller size tree may soon catch up to the growth rate of a larger tree in a grate.
All trees should fit the microclimate, soils, sun, moisture, budget, and maintenance environment in which they are planted.
Trees selected for urban streets should be able to endure pollution …minimal water …
Trees and irrigation techniques that require minimal water should be considered.
Irrigation must be designed to deliver the appropriate amount of water to each tree with minimum waste.

B. …species which are recommended for street tree planting…are preferred for their…drought resistance.

II.

A. …a permeable paving system should be considered to enhance the survivability of street trees.

B. Where possible, low water-requiring plants should be selected. Trees and shrubs will require less water and thrive better if placed in planting beds rather than turf areas.
Water-loving plants should be used in naturally moist areas and should be irrigated separately or provided run-off water to minimize irrigation needs.
The City and County of Denver is committed to the reduction of water consumption in landscape irrigation and encourages the application of xeriscape design and maintenance principles.

C. Mulches are recommended…to…conserve moisture.

V. E. Irrigation systems within grates are preferred…

The irrigation system should be on a zone separate from all other landscape zones…

X. Tree lawns should not be removed for parking in any residential neighborhood.

C. Landscaping improves…environmental conditions.
All plants should be suited to the Denver climate…
Landscaped areas must have a properly designed irrigation system providing full coverage on all plant material areas.
According to the Guidelines for Xeriscape Implementation, methods for harvesting runoff water for use onsite are encouraged to reduce the need for potable water for irrigation and to reduce burdens on storm drainage systems.

XI. Property owners are responsible for the watering of the trees and tree lawn in front of their property and the areas between their property and the street.
…the inclusion of a properly designed and maintained automatic irrigation system can…reduce water consumption.
Dry wells are recommended for areas in which property owners are willing to be responsible for hand watering in residential and small commercial areas only. This water-conserving irrigation technique involves watering the tree manually with a hose the first three or four years until the tree is established enough to survive on its own. Winter waterings are highly recommended for young trees during dry winters.

A. Proper maintenance can prolong the life and beauty of landscaping.
Monitor irrigation to avoid over-watering or under-watering.

B. Commercial streetscapes should be irrigated with a properly designed irrigation system to cover all plant material in the public right-of-way.
Irrigation systems should be designed to permit turfgrass to be irrigated separately from all other planting areas.
Rainfall or soil moisture sensors, check valves, pressure reducers, and flow sensor valves are all desirable for reducing water waste.

Water Guidelines for Newly Planted Trees

Factors to consider:

1. Species of tree
2. Soil composition and structure
3. Exposure to drying winds and sunlight
4. Irrigated or non-irrigated area

Aurora's Landscape Manual and Ordinance
Ordinances Relevant to Tree Planting and Selection in Aurora

Aurora, the third largest city in Colorado, has a population of more than 303,000 and is located east of Denver (City of Aurora 2005). Aurora has a street tree program which plants trees in the public right-of-way each spring. Trees are planted 4 to 5 feet behind the sidewalk and 45 feet apart. Aurora stresses that "trees we plant are suited for Aurora's climate and growing conditions" and requests that residents water newly planted trees frequently for the first two or three growing seasons to establish the tree and maintain it during extended periods of drought. Guidelines and ordinances for tree selection and planting in Aurora are found in two documents: the Landscape Ordinance which can be accessed online at http://www.auroragov.org/stellent/groups/public/documents/article-publication/007646.pdf and the Landscape Manual written by Don Fecko at http://www.auroragov.org/stellent/groups/public/documents/article-publication/007808.pdf.

The Landscape Ordinance

The City of Aurora's landscaping goals are "to protect and promote the public health, safety, and welfare" in two ways: by establishing a high standard for quality development and by preserving, protecting, and enhancing existing neighborhoods and "mitigating adverse visual impacts caused by human interaction with the environment via

- Preserving trees
- Conserving and protecting water resources
- Requiring adherence to water- wise and xeriscape principles during the design, implementation, and maintenance of landscapes (emphasis added).
- Providing compatibility among uses
- Protecting wetlands
- Buffering transportation corridors, view corridors, public open space, and public parks."

Sec. 146-1410 Definitions. (H) Xeric Plants. Xeric, xeriscape, drought-tolerant, or drought-resistant landscaping and/or plant species shall mean plant species that can survive on one half-inch to one inch of water per week and are listed in the reference materials found in Section 146-1426.

Sec. 146-1422 Landscape Street Buffers. (C) States that all street buffers must contain at least one tree and ten shrubs or a tree and the shrub equivalents listed in Section 146-1426 (I) (J) per 40 lineal feet.

Sec. 146-1424 Special Landscape Buffers. (C) States that the total number of trees and shrubs should be equal to one tree and ten shrubs per 25 linear feet of frontage for industrial development and one tree and ten shrubs per 30 feet of frontage for any other development.

Sec. 146-1426 Plant Material Requirements. (B) States that at least 75 percent of all of the plant material in a landscape be selected from the low water usage zone of the City of Aurora's Plant List, the City's Xeriscape Plant List or the CSU Cooperative Extension Fact Sheets on Xeriscaping. (C) States that shade trees be at least a 2.5 inch caliper, except in single-family

detached developments where shade trees should average 2.5 inch caliper. Ornamental trees should be minimum 2 inch caliper. Evergreens should be at least six feet tall.

Sec. 146-1431 Living Material Requirements. (B) States that at least 50 percent of the landscaped area be covered with living plant material.

Sec. 146-1436 Prohibited Plant Species. States that the following trees may be prohibited by the Director of Planning if they are established as being detrimental to the public health, safety, or welfare:

- Russian Olive – all Elaeagnus Angustifolia species and cultivars
- Aspen – all Populus Tremuloides species and cultivars
- Cottonwood – all species
- Tamarisk - all species and cultivars
- Invasive species – all plants listed as invasive by the CSU Extension Service

Sec 146-1437 Xeriscape Design. States that xeriscape landscapes should follow the seven principles of Xeriscape design:

1. Planning and design
2. Turf alternative
3. Mulches
4. Zoning of plants
5. Soil improvements
6. Efficient irrigation
7. Appropriate maintenance

(E) States that hand watering is not permitted without approval by the City (emphasis added).

Sec 146-1439 Parking Lot Landscaping. (A) States that islands should have one shade or ornamental tree and one or more understory treatments. (B) States that medians should have one shade or ornamental tree for each 30 linear feet of median length and one or more understory treatments.

Sec 146-1450 Additional Requirements for Residential Development. (A) States that landscaping be integrated with the existing design/environment and that a variety of plant materials be incorporated into the project with an equal distribution of deciduous and evergreen trees. (B) States that street trees be centered within the tree lawn and spaced 40 feet apart, 4 to 5 feet from the curb or pavement using large deciduous tree species.

Sec 146-1451 Additional Requirements for Non-Residential Development. (A) States that "a variety of plant materials shall be incorporated into each project, including native drought-tolerant vegetation and perennial and annual flowerbeds. Tree plantings shall include an equal distribution of deciduous and evergreen species."

Sec 146-1470 Purpose. (A) Refers to the unique Black Forest ecosystem as a representative ecosystem consisting of non-mountainous Ponderosa Pine extending into the high plains. It continues, arguing that the Gambel Oak and the Ponderosa Pine in the Black Forest zone supply

habitat, beauty, and soil-erosion protection to the region. (B) Acknowledges the Black Forest as an asset to the community which provides:

- Energy conservation through shade and evapo-transpiration
- Reductions in air pollution by absorbing carbon dioxide, ozone, and particulate matter
- Wildlife habitat for birds, small mammals, and other species
- Alleviation from soil erosion, siltation, and excess runoff
- Increased real property values
- Enhanced natural visual and aesthetic qualities

The Landscape Manual

The City of Aurora's Landscape Manual includes the requirements for the submittal of a landscape plan, a thorough Recommended Xeriscape Plant List, and the City Council's policy for preserving existing trees. The requirements for a landscape plan submittal include a plant list and legend, defined water zones, a tree preservation table, and a water usage table.

- The plant list must show quantities of plants, their common and botanical names, descriptions, and water usage requirements for each species.
- Water Zones "should be shown as low (L), moderate (M), and high (H). The Recommended Xeriscape Plant List and the City of Aurora Plant List group plant materials by water usage."
- The tree preservation table states that the plans should show total caliper inches of trees that will be added, removed, relocated, or kept.
- The water usage table is required and should illustrate "the square footage of water conserving landscaping (non-turf areas), and square footage of non-water conserving landscaping (turf areas)."

Recommended Xeriscape Plant List

The City of Aurora first lists its sources that contributed to its plant list including Garden Centers of Colorado, Watersaver.org, Denver Water, Colorado State University, CSU Cooperative Extension, and the City of Aurora Utilities Department. Aurora's list utilizes the Garden Centers of Colorado's ratings of "X" for plants that need 1 inch of water per week, "XX" for plants that need .5 inches of water per week and "XXX" for plants that need .5 inches every two weeks (see Appendix A).

City Council Tree Preservation Policy

The aim of the City Council's policy is the "preservation of existing, mature, and desirable trees from destruction during the development process… Mature trees within the City of Aurora which are alive and in good health condition shall remain in their present location and shall be safeguarded from damage due to site development." The policy stresses that "no tree for mitigation shall be less than 2 inches in caliper and shall be of no less quality species than the tree removed. A Blue Spruce could not be replaced with an Upright Juniper."

Model Ordinances from City of Aurora – Landscape Ordinance & Manual

Landscape Manual - Plan requirements
Water Zones – Show water usage requirements for each plant species listed on the plant list. Water usage requirement should be shown as low (L), moderate (M), and high (H).

…soil preparation, listing type and quantity of amendments(s) to be applied. Four cubic yards of organic material per 1,000 square feet of area is the minimum amount currently required for obtaining a lawn permit.

Statement describing the irrigation treatment for the development that reads, "All landscaped areas and plant material, except for non-irrigated native…must be watered by an automatic underground irrigation system."
Tree Preservation Table
Water Usage Table…square footage of water-conserving landscaping (non-turf areas)…
Landscape Ordinance – Landscaping

Sec. 146.1400. Purpose
(2) Preserving, protecting, and enhancing existing neighborhoods and the image of the City of Aurora by mitigating adverse visual impacts caused by human interaction with the environment by means such as:

a. Preserving trees
b. Conserving and protecting water resources
c. Requiring adherence to water-wise and xeriscape principles and practices during the design, implementation, and maintenance of landscapes
d. Providing compatibility among uses
e. Protecting wetlands

Sec. 146-1413. Declared Drought Emergency
At such times as the City Council may declare a drought emergency, the installation of various type of landscaping as required by this section may be postponed.

Sec. 146-1420. Tree Preservation
All applicants are required to comply with tree preservation, relocation, and mitigation requirements found in the City's adopted Policy on Preservation of Existing Trees.

Sec. 146-1422. Landscape Street Buffers
(C) All required street buffers shall contain a minimum of one street tree and ten shrubs or the tree and shrub equivalents listed in Section 146-1426(I)(J) per 40 lineal feet.

Sec. 146-1426. Plant Materials Requirements
(B) At least 75 percent of all trees, shrubs, annuals, perennials, groundcovers, and ornamental grasses used to landscape each site regulated by this article shall be selected from the low water usage zone found in the City of Aurora Plant List; the City of Aurora Recommended Xeriscape Plant list; the Colorado State University Cooperative Extension Fact Sheets on Xeriscaping; or other approved water wise, resource-wise, or xeriscape plant material references.

Sec. 146-1429. Re-establishment of Non-irrigated Native, Dryland, and Restorative Grasses
(G) All trees and shrubs located within non-irrigated turf areas shall be watered by a permanent underground automatic irrigation system except in re-established wetland areas.

Sec. 146-1430. Irrigation
…developments shall install automatic rain shutoff sensors…

Sec. 146-1470. Black Forest
(B) Purpose of the Black Forest Ordinance… These actions are intended to contribute to the health, safety, and welfare of Aurora residents by acknowledging the functions that tree stands provide, including:

- Conserving energy through shade and evaporative cooling
- Reducing localized air pollution through absorption of carbon dioxide and ozone and absorbing particulate matter
- Alleviating soil erosion, siltation, excess stormwater runoff, and other harmful effects of land disturbance practices

City of Boulder
Design and Construction Standards

The City of Boulder, with a population over 100,000, is in the foothills of the Rocky Mountains just 35 miles Northwest of Denver (Boulder Chamber of Commerce 2006). The relevant standards for landscaping in Boulder can be downloaded from their website at: http://www.ci.boulder.co.us/index.php?option=com_content&task=view&id=209&Itemid=482 or purchased for $75 at the Planning and Development Services Center. Chapters three and ten, the most relevant section of the standards for The IES Tree Project, are entitled Streetscape Design and Tree Protection and Streetscaping Standards, respectively and are summarized below.

Chapter Three
Streetscape Design and Tree Protection

This chapter is divided into six sections which include:

1. General
2. Landscaping Plan
3. Street Trees and Plants
4. Tree Removal and Tree Location
5. Tree Protection for Construction Sites
6. General Landscaping and Maintenance Requirements

1. General

The stated purpose of the City of Boulder's streetscape design standards is "to improve public safety by preventing sight distance and facility obstructions and sidewalk and street damage, to promote suitable landscape species selection for streetscapes, to minimize tree and landscape maintenance costs, and to create an aesthetic community image through continuity."

This section states that these standards are applicable to

- Streetscapes
- Private construction sites
- Public rights-of-way

Any work done on trees, including planting, maintenance, and removal is subject to permit approval by the City of Boulder.

2. Landscaping Plan

This section emphasizes that a formal landscape plan must be submitted and in compliance with these standards for any project that will involve development within the public right-of-way. This section also delineates what ought to be included in such a plan: the location, type, and size of existing trees and the location, type, and size of trees that will be planted, removed, or relocated.

3. Street Trees and Plants

Trees to be planted in a non-paved, public right-of-way must be chosen from Appendix A unless an alternative tree is approved by the City with the exceptions that it is thorn-less, cotton-less, minimally fruiting, and minimally seeding. Recommended distances are

Small trees	4-5 – foot minimum strip width	15-20 feet apart
Medium trees	6-7 – foot minimum strip width	25-30 feet apart
Large trees	8 – foot minimum strip width	30-40 feet apart

Trees selected for a 4 to 5 foot strip must be upright varieties. Planting trees is not recommended in a width less than 4 feet or where the minimum space recommended for the tree is inadequate. Evergreens are not recommended for the public right-of-way because of their potential for overcrowding and sight obstruction.

"Whenever possible, trees should be selected from species noted as 'drought tolerant'(emphasis added)."

The City recommends that a variety of trees be planted at any given site to prevent uniform disease susceptibility. Percentages of any one species to be planted are outlined below.

Number of Trees at Site	Maximum Percentage of One Species
10-19	50%
20-39	33%
40 and over	25%

Trees proposed for planting downtown should follow the Downtown Urban Design Guidelines, 1999.

Other restrictions include:

- Consideration of expected mature tree height and canopy spread
- Consideration of potential sight and physical obstructions of mature trees
- Newly planted trees at least 10 feet from underground utility lines
- Not placing trees within 20 feet of a utility pole (only small trees should be placed under power lines)
- Placing trees 10 feet from buildings and column or pyramid-shaped in restricted space
- Newly planted trees adjacent to existing trees which should be given adequate space to grow (emphasis added)
- Planting trees in the center of strips, right-of-ways, and medians
- Not planting trees in any space less than 4 feet wide
- Placing evergreens at least 10 feet behind the edge of the pavement
- Not planting evergreens on the south side of east-west running streets

Section C incorporates the standards relevant to trees in grates or planting pits.

Section D refers to selection and placement standards for plants in medians.

4. Tree Removal and Tree Location

This section states that a right-of-way permit and approval of the landscaping plan is required before removal or relocation of any tree. The applicant may not request approval or propose removal or relocation of a tree in the public right-of-way unless it meets one the following conditions: the site could not "feasibly be developed" without removing the tree, the tree is characterized by the City as undesirable, or the City is requiring the removal of the tree as part of the plan.

Trees in the landscape plan will not be counted towards mitigation plantings. Undesirable trees in the public right-of-way include:

- Trees that are less than 1 inch caliper
- Trees less than 12 inches in diameter that are on the prohibited tree list
- Damaged or diseased trees
- Trees that do not conform to existing standards

Tree removal and relocation procedures are outlined at the end of this section.

5. Tree Protection for Construction Sites

This section states that where any public improvements are being proposed, existing trees and plants must be protected. Proposed tree protection measures should be a part of the landscaping plan submitted for approval. If damage occurs as a result of construction activities, the City must be notified within 24 hours.

Tree protection measures should address soil compaction prevention, root protection, fencing, grade changes, transplanting, chemical and foreign material disposal, and pruning.

6. General Landscaping and Maintenance Requirements

Section 6 suggests that landscaping maintenance begin immediately after all materials are planted; maintenance includes "watering, weeding, cultivating, mulching, tightening and repairing of guy, removing dead branches, resetting plants to proper or upright position, replacing dead plants, and protecting the site from damage or vandalism."

If required by the City, the developer should submit instructions for the care and maintenance of the newly planted areas.

Chapter Ten
Streetscaping Standards

This chapter is divided into five sections which cover these topics:

1. General
2. Site Preparation
3. Planting
4. Seeding/Sodding
5. Underground Irrigation System

1. General

The purpose of Chapter 10 is to "complement the design standards specified in Chapter 3, Streetscape Design and Tree Protection… and provide minimum standards for the construction and planting of streetscapes in public rights-of way." These guidelines are applicable to any plant material within the public rights-of-way. All proposed work is subject to City of Boulder approval.

Water conservation is of concern; the standards state that "all landscaping shall be designed for maximum water efficiency."

These standards do not apply to public lands other than public rights-of-way such as parks, open space, and corridors; however, these standards may be used as a basis for development on all public land.

2. Site Preparation

This section describes site preparation, which includes layout, tree protection, demolition, clearing, excavation, fill, backfill, top-soiling, and finish-grading and outlines the procedures for each of these activities.

3. Planting

These standards govern the planting of trees and shrubs, the best methods to ensure protection and healthy growth, and the methods of maintaining landscape plants.

First, proper materials for use are delineated, including edgers, mulches, etc.

Within the Plant Materials subcategory, the standards state that "all plants shall be 'Colorado Grown,' 'Colorado Fielded' or 'Northern Grown' as described below, unless otherwise specified in these Standards, except for plants of the genus Juniperus."

'Colorado Grown' refers to plants grown in a Colorado nursery for a major portion of their lives. 'Colorado Fielded' refers to plants that have been growing in a Colorado nursery for at least two growing seasons, and 'Northern Grown' refers to plants grown in nurseries located between hardiness zones 1 and 5.

All plants also have to meet the following requirements:
- Maximum water efficiency
- Grouped according to their water requirements

- Labeled with correct genus, species, and common and variety name with a weatherproof label until checked by the City inspector

Chapter 3 continues with subcategories addressing construction requirements, plant protection and delivery, the excavation of the planting pit, planting and staking for installation, spraying, wrapping, pruning, watering and mulching for plant installation, and moss rock installation procedures.

4. Seeding/Sodding

This section defines sodding as "the planting and installation of grasses, preparation of soils and grading, and the methods to be applied in planting and maintaining grasses." It lists the proper uses of fertilizer, the type of grasses allowed, soil amendments, and how they should be kept.

5. Underground Irrigation System

The final section of Chapter 10 outlines irrigation requirements. Underground irrigation includes "pipelines, sprinklers, valves, and controllers." Under the subcategories materials and construction requirements, the types of components to be employed are thoroughly described.

Model Ordinances: City of Boulder

Chapter 3

3.01 General
(A) …to promote suitable landscape species selection…

3.03 Street Trees and Plants
(7) Whenever possible, trees should be selected from species noted as "drought-tolerant" in Table 3-1.

3.06 General Landscaping and Maintenance Requirements
(B)(2) Landscaping maintenances shall include, without limitation, watering, weeding, cultivating, mulching, tightening, and repairing of guys, removing dead branches, resetting plants to proper grade or upright position, replacing dead plants, and protecting the site from damage or vandalism.

Chapter 10

10.01 General
(E) All landscaping shall be designed for maximum water efficiency, as specified in Section 9-3.3-3, 'Landscape Design Standards,' B.R.C. 1981.

10.02 Site Preparation

(C)(3)(c) Using hand methods of excavation within the drip line of trees.

10.03 Planting
(B)(7)(a) …landscape plantings shall be mulched with 4 to 6 inches of wood chips.
(B)(8)(b) All plants shall be of species identified in and allowed by these Standards and shall conform to the following:
(i) Selected to meet the goal of maximum water efficiency and zoned or grouped according to their water requirements.

(C)(5)(f) All deciduous trees shall have a sod-free base at least 3 feet in diameter. All evergreens trees shall have a sod-free base extending to the dripline.

(C)(6)(c) After watering on the day of planting and throughout the maintenance period, the contractor shall ensure that plants are not over-watered.

City of Fort Collins – Streetscape Design Standards & Guidelines

Section 2 – For Medians

2.1 … to require preparation of median landscape plans that ensure significant canopy shading to reduce glare and heat build-up…reduce erosion and stormwater runoff and mitigate air pollution.

2.5.2.c Organic mulch shall be placed at a depth of 3 inches directly on top of the soil surface in all landscape areas.

2.8 Additional Standards. Water conservation; Tree Protection and Replacement

Section 3 – For Parkways

3.1 … to require preparation of median landscape plans that ensure significant canopy shading to reduce glare and heat build-up…reduce erosion and stormwater runoff and mitigate air pollution.

3.4.1 …canopy shade trees shall be planted at 30-40 foot intervals in the center of all such parkway areas.

3.4.4 Xeriscape design principles should be incorporated whenever appropriate in accordance with the requirements identified in Part II of the Planting Standards Section.

Section 5 – Planting Guidelines

5.1 Due to severe climate conditions in Fort Collins, consideration of long-term maintenance is an important element of the initial design of any streetscape.
5.2 Xeriscape methods are advisable, such as grouping plants with similar water demands together and watering higher-demand plants on a different sprinkler schedule, while

drought-tolerant plants may be watered by rain or bubbler irrigation. Soil preparation is a critical step in all Xeriscape.

Section 6 – Planting Standards

6.1.1 Public projects such as parks, streets, medians, substations, treatment plants, plazas, and public buildings shall provide for tree planting as a part of the development process.

6.1.2 Private projects shall provide for street tree planting as part of the development process.

6.2.1 Existing healthy street trees shall be preserved wherever possible. If a tree is removed, mitigation trees shall be provided of at least equal value as that of the removed tree.

6.2.2 Except in residential areas, automatic irrigation shall be provided to all trees…

Section 11 – Establish Maintenance for Newly Planted Trees

11.1 Newly occupied residences shall be contacted regarding street tree planting and maintenance requirements.

11.2.1 Newly planted trees require additional irrigation for two to three years. New trees should receive 2 inches of irrigation per week, during the first growing season, applied over the root system. Normal turf irrigation is generally adequate (1 inch per week) for the second and third year. Fifteen inches of supplemental irrigation per growing season is adequate after establishment.

11.2.2 Newly planted trees shall be mulched over the root system with 4 inches of organic mulch.

11.2.6 Re-mulch trees on an annual basis to maintain a 4-inch deep mulch cover.

11.2.7 Maintain tree rings in turf zones as weed-free

City of Fort Collins Streetscape Design Standards and Guidelines

Fort Collins is located 58 miles north of Denver in Larimer County and has a population of more than 137,000 (City of Fort Collins 2006). The standards and guidelines for landscaping in Fort Collins were last updated in January 2001. The document is divided into the following sections; however, only sections relevant to The Tree Project are summarized below:

1. Introduction
2. General Landscape Design Standards and Guidelines for Median
3. General Landscape Design Standards and Guidelines for Parkways
4. Illustrations of Design Standards and Guidelines
5. Planting Guidelines
6. Planting Standards
7. Irrigation Standards
8. Turf Seeding Standards
9. Fine Grading and Soil Preparation Standards
10. Streetscape Maintenance Standards
11. Establishment Maintenance for Newly Planted Trees

1. Introduction

The stated purpose of the City of Fort Collins' Streetscape Design Standards and Guidelines is "to ensure that the quality of the streetscape environment, including medians and parkways within the public right-of-way, is attractive and functional and links the public street corridors together through a unified city-wide plan. Standards are mandatory and co-notated with the words "shall," "must," and "will," while guidelines are signified by the words "should" or "may."

2. General Landscape Design Standards and Guidelines for Median

The stated purpose of this section is to ensure that landscaping works to reduce glare and heat buildup, contribute visually to the community, enhance the outdoor public space, reduce erosion and stormwater runoff, and mitigate air pollution.

2.5.1 Tree Corridor Style states that trees shall be planted in an evenly spaced row, whether large or ornamental, and that strong contrasts of form, size, texture, and color be avoided within the rows. Trees in the median shall be planted at 25 feet minimum to 30 feet maximum distance from each other.

2.5.2 Variety Combination Style states that continuity is not achieved by a continuous repetition of the individual elements, but by "the occasional repetition of a dominant tree form… Plant groups placed between the repetitive dominant tree forms may be in sharp contrast to each other – in terms of size, color, form, and texture – to emphasize visual variety and detail." Trees selected for the median can be any type but must be at least 12 feet wide for evergreens.

Deciduous trees and evergreen trees should be at least 3.5 feet and 6 feet from the curb, respectively. Spacing should be as follows:

Tree	Minimum distance	Maximum distance
Shade	25 feet	40 feet
Ornamental	20 feet	30 feet
Evergreen	20 feet	30 feet

3. General Landscape Design Standards and Guidelines for Parkways

3.4 Parkway Planting Design Options state that shade trees shall be planted at 30 to 40 foot intervals and centered in all parkways where the sidewalk is not attached to the street. Furthermore

- If the sidewalk is attached, then trees shall be placed between 3 to 7 feet behind the sidewalk and spaced at 30-40 foot intervals. If the sidewalk is 10 feet of more in width, trees shall be planted in cutout areas of at least 16 square feet and at 30 to 40 foot intervals.
- Ornamentals shall be planted where overhead utilities would restrict a large tree's growth.
- This section suggests that xeriscape design principles be incorporated when appropriate and in accordance with the requirement in Part II of the Planting Standards Section.
- Larger trees should be planted in the center of the parkway spaced 40 feet apart. Small trees should be spaced 20 feet apart, unless space is limited. If a certain design effect is desired, closer spacing may be considered.
- Eight feet is the minimum distance a tree should be planted from the edge of a driveway or alley.

3.6 Visual Clearance or Sight-Distance Triangle states that a deciduous tree may be planted within a sight-distance triangle as long as the branches are at least 6 feet from the grade.

5. Planting Guidelines

5.1 Weather, Climate, Soils takes the Fort Collins environment into consideration. It states that because of the severe climate, long-term maintenance of the landscape should be taken into consideration. It emphasizes that 15 inches of rain per year is the average precipitation. It notes that extreme temperatures are experienced throughout the year, when precipitation typically falls, that heavy spring snows may break tree limbs that the area experiences sudden frosts, and that heavy clay soils are naturally alkaline with low humus production.

5.2 General Planning Considerations states that the above conditions require careful selection of vegetation. "Xeriscape methods are advisable, such as grouping plants with similar water demands together and watering higher-demand plants on a different sprinkler schedule while watering drought-tolerant plants by rain or bubbler irrigation. Soil preparation is a critical step in all xeriscape (emphasis added)." It further recommends that by varying tree types, a rhythm or

pattern is set for the street that provides a sense of enclosure as slower growing trees are established.

6. Planting Standards

6.1 Projects Governed by City Planning Standards states in 6.1.1 and 6.1.2 that public and private projects shall provide for street tree planting in the public right-of-way as part of the development process. All plans must adhere to the City Forestry Standards and Specifications.

6.2 Specific Standards require that

- Existing healthy street trees shall be preserved wherever possible.
- Mitigation is required of at least equal value for the tree that is removed.
- New trees must be at least 2 inch caliper on arterial or collector streets.
- New trees must be at least 1.25 inch caliper on residential streets.
- There in no minimum size for infill tree plantings.
- Automatic irrigation is required except in residential areas.

6.3 Size, Type, and Distribution of Tree Species requires that

- New trees be planted via the balled and burlapped, spade, or container methods. Bare root plantings are not permitted without special authorization.
- No single species can make up more than 15 percent of the total tree population
- Required percentages of species recommended per site are

Number of Trees at Site	Maximum % of any one Species
10 to 19	50
20 to 39	33
40 to 59	25
60 or more	15

- No species other than those listed in the Appendix are permitted to be planted without special authorization from the City Forester.

10. Streetscape Maintenance Standards

10.1 Purpose is to "ensure a consistent, high quality appearance for all streetscapes, whether maintained by the City, its agents, or by private developers, businesses, or individuals."

10.3 Permit states that a free permit must be obtained from the City Forester before any work is done on a tree in the public right-of-way.

10.4 Maintenance Responsibilities states that

- Parkways on connector/local streets and residential streets are the responsibility of the adjacent property owner with a few exceptions.
- Trees on the city's right-of-way are the responsibility of the Forestry Division.
- Civic groups and other association are encouraged to adopt a median to maintain in the city's Adopt a Median program.

10.5 Maintenance Standards for trees and shrubs state

- Trees must be maintained in a manner that promotes their health.
- Tree must be maintained in a manner that does not interfere with public safety; limbs must be 14 feet above streets and 8 feet above sidewalks.
- Limbs overhanging public rights-of-way must be pruned.

11. Establishment Maintenance for Newly Planted Trees

11.2 Establishment Maintenance Standards addresses best management practices for newly planted trees via the following guidelines:

- Newly planted trees require additional irrigation for two to three years.
- New trees should receive 2 inches of water each week during the first growing season.
- Newly planted trees should be mulched with at least 4 inches of mulch over the roots.
- New plantings should be inspected on a regular basis.
- Remove sprout growth from stems and root collars early in the growing season.
- Re-mulch trees on an annual basis, maintaining 4 inches of mulch.
- Keep tree mulch rings weed-free.
- Monitor insect and disease levels.
- Remove tree wrap the next spring season.

Model Ordinances: City of Fort Collins

Section 2 – For Medians

2.1 … to require preparation of median landscape plans that ensure significant canopy shading to reduce glare and heat build-up…reduce erosion and stormwater runoff and mitigate air pollution.

2.5.2.c Organic mulch shall be placed at a depth of 3 inches directly on top of the soil surface in all landscape areas.

2.8 Additional Standards. Water conservation; Tree Protection and Replacement

Section 3 – For Parkways

3.1 … to require preparation of median landscape plans that ensure significant canopy shading to reduce glare and heat build-up…reduce erosion and stormwater runoff and mitigate air pollution.

3.4.1 …canopy shade trees shall be planted at 30-40 foot intervals in the center of all such parkway areas.

3.4.4 Xeriscape design principles should be incorporated whenever appropriate in accordance with the requirements identified in Part II of the Planting Standards Section.

Section 5 – Planting Guidelines

5.3 Due to severe climate conditions in Fort Collins, consideration of long-term maintenance is an important element of the initial design of any streetscape.
5.4 Xeriscape methods are advisable, such as grouping plants with similar water demands together and watering higher-demand plants on a different sprinkler schedule, while drought-tolerant plants may be watered by rain or bubbler irrigation. Soil preparation is a critical step in all Xeriscape.

Section 6 – Planting Standards
6.1.3 Public projects such as parks, streets, medians, substations, treatment plants, plazas, and public buildings shall provide for tree planting as a part of the development process.
6.1.4 Private projects shall provide for street tree planting as part of the development process.
6.2.3 Existing healthy street trees shall be preserved wherever possible. If a tree is removed, mitigation trees shall be provided of at least equal value as that of the removed tree.
6.2.4 Except in residential areas, automatic irrigation shall be provided to all trees…

Section 11 – Establish Maintenance for Newly Planted Trees
11.2 Newly occupied residences shall be contacted regarding street tree planting and maintenance requirements.
11.2.3 Newly planted trees require additional irrigation for two to three years. New trees should receive 2 inches of irrigation per week, during the first growing season, applied over the root system. Normal turf irrigation is generally adequate (1 inch per week) for the second and third year. Fifteen inches of supplemental irrigation per growing season is adequate after establishment.
11.2.4 Newly planted trees shall be mulched over the root system with 4 inches of organic mulch.
11.2.8 Re-mulch trees on an annual basis to maintain a 4-inch deep mulch cover.
11.2.9 Maintain tree rings in turf zones as weed-free

City of Westminster Landscape Regulations 2004

Westminster is located in the northwestern part of Denver's greater metropolitan area. It has a population of more than 100,000 people (City of Westminster 2006). Its landscape regulations can be viewed online at http://www.ci.westminster.co.us/gov/depts/cd/Planning/LandscapeRegs904.pdf.

Westminster organizes its landscape regulations into the following sections:

I. Statement of Intent
II. Applicability
III. Adjustment of Requirements
IV. Other References
V. Considerations in Landscape Design
VI. General Landscape Provisions for Plant Material, Design, and Installation Requirements
VII. Residential Landscape Standards
VIII. Right-of-Way Landscape Standards
IX. Parking Lot Landscape Standards
X. Non-Residential Landscape Standards
XI. Landscape Regulations Chart
XII. Landscape and Irrigation Plan Requirements
XIII. Plant Material List by Hydrozone
XIV. Landscape Maintenance Requirements
XV. Private Improvements Agreement
XVI. Definitions

I. Statement of Intent

The goal of Westminster's landscape regulations is to "provide minimum design, installation, and maintenance criteria for landscape elements." It lists several benefits that landscaping should provide to the community including:

- Enhancement of property values
- Improvement of air and water quality
- Reduction of heat, glare, dust, and noise
- Buffering or framing of views
- Provision of wildlife habitat and living environment
- Seasonal interest and visual enhancement
- Efficient use of water resources

II. Applicability

These regulations apply to the following situations:

- New development
- Redevelopment
- Amended official development plans
- Existing, non single-family detached development with no official plan
- Existing, single-family detached residential development with no official plan

III. Adjustment of Requirements

The Planning Manager can authorize adjustment from the regulations when the requirements cause practical difficulties or unnecessary hardship. However, any adjustment granted is not to set a precedent. City projects that include "parks, street medians, or public utility facilities may have unique requirements for landscaping and will be reviewed on an individual basis."

IV. Other References

This section lists other documents that are relevant to landscaping requirements and regulations.

V. Considerations in Landscape Design

This section outlines the design elements that are to be considered and incorporated into the landscape and irrigation plan.

A. Water Conservation/Water-Wise Landscaping/Xeriscaping

This subsection states that Westminster has a semi-arid climate with an average of 14 inches of precipitation each year. It acknowledges that many landscapes use plants that are from regions which receive more rainfall and that supplemental irrigation is necessary to keep these landscapes alive.

Next, the concept of xeriscape is described. Xeriscape, according to Westminster, was developed in Denver as a result of water shortages and is "an attractive landscape that uses little supplemental water." It promotes water conservation and landscapes that have seasonal interest, flowers, and greenery. The regulations list and describe the seven principles of xeriscaping.

Principle	Description
Design	Identification and development of different water zones or "hydrozones."
Irrigation	Proper irrigation is needed to establish and maintain plants that require supplemental irrigation. Watering deeply and less frequently results in more drought-tolerant plants.
Soil Preparation	Important to the success of the landscape. Adding organic material such as compost results in soils that hold water longer and improve air circulation and root development.
Mulch	Covering bare soil, mulch serves to reduce evaporation, soil temperature, and weed growth.
Appropriate Use of Turf	Determine the use of turf in the plan and consider various grasses' suitability, growth habitats, and maintenance requirements.
Use of Low Water Plants	Plant selection and grouping can result in a beautiful landscape that requires less supplemental irrigation.
Maintenance	Regular and periodic maintenance are a necessary part of xeriscape.

Various "water-wise elements" are required to be incorporated into any landscape design in order to reduce the impact of a drought (emphasis added). The elements are

- Incorporation of low, moderate, and high hydrozones.
- Total annual water application by irrigation that cannot exceed 15 gallons per square foot per year.
- Low hydrozones that require 3 gallons per square foot per year or less.
- Moderate hydrozones that require 10 gallons per square foot per year.
- High hydrozones that require 18 gallons per square foot per year.
- High hydrozones not placed within 5 feet of a building foundation; it is desirable to transition to a low water zone towards paved areas.
- Automatic irrigation systems required for all landscapes.
- Soil preparation that must include rototilling and incorporation of compost A more thorough soil analysis is recommended but not required.
- Mulching required in moderate and high hydrozones, in-organic mulch only permitted in low water zones
- Plant selection matched to the water needs of the hydrozone

B. Existing Vegetation

Any tree greater than 4 inches in caliper must be depicted on the landscape plan and preserved unless otherwise approved by the City. Grading is not allowed within the drip line of trees. Tree wells or walls are allowed beyond the drip line. The number of trees preserved is credited toward the total number of trees required for the development, and any replacement trees have to be greater in number than the minimum required number of trees. A removed tree must be replaced by a 2:1 caliper-inch ratio.

C. Canals and Watercourses

Setbacks are required along canals, irrigation ditches, and watercourses to ensure against slope failure and to maintain access to the watercourse. The regulations further state that "where trees exist within 20 feet of the top of the watercourse bank, the edge of any improvement shall be set back a minimum of 20 feet from the tree trunk or from a line connecting tree trunks less than 50 feet apart."

The drip line of a tree must be fenced prior to the start of any construction activities.

D. Plant Selection and Design

Westminster promotes a formal design approach for medians, in which shade trees are regularly spaced in a "repetitive and predictable pattern." Trees should also be planted on both sides of the sidewalk to create a canopy and provide shade to pedestrians.

For medians, Westminster provides the species required in order to create visual appeal and limit potential diseases. A variety of evergreen and deciduous trees and shrubs is required for year-

round visual appeal. Long-living deciduous trees are preferred, and fast-growing trees that are vulnerable to damage are allowed only on a limited basis.

If non-potable water will be used to water the landscape, plants tolerant to high levels of salt and potassium must be utilized.

E. Buffering Between Uses

Buffering is encouraged between properties with differing uses in order to control noise and visual disturbances. Westminster recommends the use of berms not steeper than 4:1 in combination with evergreen and deciduous trees.

F. Sight Triangles

The regulations require that sight triangles be depicted in the landscape plan. Any object within the sight triangle cannot be taller than 24 inches above the adjacent curb height. Evergreen trees cannot be planted in the sight triangle. Deciduous trees are discouraged within the sight triangle, because large trunks of mature trees can obscure the view.

G. Medians, Landscape Islands, and Landscape Adjacent to Hardscape

Medians should be at least 50 feet long and 10 feet wide and are maintained by the property owner or homeowner's association listed on the plans. The planting area height should be at or below the curb to minimize runoff and assist in maintenance.

H. Drainage and Detention Areas

The developer or owner must consider maintenance issues when planning and installing drainage and detention areas and must be in compliance with Urban Drainage and Flood Control District regulations.

Trees must be above the 5-year stormwater surface elevation.

I. Trash and Loading Area Screening

This section states that dumpsters must be screened according to zoning requirements and refers to fencing and walls, retaining walls, and utilities, fire hydrants, and easements in landscaping. The planting of large trees is discouraged near terraces or walls. Landscaping must consider the mature size and shape of trees near overhead utilities. No plants are allowed within a 5-foot setback from fire hydrants.

VI. General Landscape Provisions for Plant Materials and Their Design and Installation

Westminster emphasizes that these regulations be considered minimum (emphasis added) requirements; owners are encouraged to increase the number of plants used when possible, and in certain cases, the City may require landscaping above and beyond the minimum. The owner

must also contact the City to determine the project proximity to the non-potable water system and the possibility of using this system.

Plants installed must meet the minimum requirements of the American Standards for Nursery Stock in regards to health, size, and general appearance.

All landscaped areas are required to incorporate soil amendments according to the City's "Standards and Specifications for the design of construction of public improvement."

For properties managed by a homeowner's association or landlord of rental properties, an inspection of the soil after the amendment has been added and prior to tilling is required.

For single-family lots, a soil amendment is required by the City in all areas that do not use hardscape.

"Plants located within a particular hydrozone must be similar in water requirements to the designated zone."

A. Trees

In this section, Westminster lists design considerations relevant to tree selection.

- Long-living shade trees (Ash, Honeylocust, Linden, and Oak) are preferred over fast-growing, shorter-living trees (emphasis added). The minimum size for a shade tree is 2 inches in caliper.
- Ornamental trees cannot make up more than one-third of the total trees in a landscape, and their minimum size should be at least 2 inch caliper.
- Evergreens must make up at least one-third of the total trees required, and they must be at least 6 feet tall.
- Twenty percent of the deciduous trees must be at least 3 inches caliper, and 20 percent of the evergreen trees must be at least 8 feet tall.
- Species diversification must be based on the table below.

Number of Trees on Site	Maximum % of any Species
10-19	50%
20-39	33%
40-59	25%
60 or more	20%

- Evergreen trees cannot be planted within10 feet of a street, sidewalk, or parking area.
- "Trees should be located to provide summer shade and limit winter shade on walks and streets."
- Trees that bear fruit or thorns cannot be planted close to sidewalks, parking lot islands, or medians.
- It is prohibited to plant Siberian Elm, Chinese Elm, and Russian Olive because of insect infestation or invasive growth habits.

- Winter watering is needed.
- All trees must be surrounded by an area of mulch at least 2 feet from the trunk, 4 feet in diameter, and 3 inches deep. Increasing the size of the mulch area out to the drip line is recommended but not required.
- Tree grates must be at least 5 feet in circumference; 7 feet is preferable "for the health of the tree" (emphasis added).
- One tree may be substituted for 10 shrubs and vice versa, if approved by the City.

This section also covers design considerations for shrubs, perennial beds, and turf areas.

VII. Residential Landscape Standards

The following regulations apply to all residential areas as defined within the City's Comprehensive Land Use Plan.

The entrance to a residential development, islands, and medians should be designed to be attractive year-round and should ensure maximum visibility. "Evergreen trees planted behind the entry signage are encouraged to enhance the community character established with the City's monument signage."

A. Single-Family Detached Residential

This section begins by outlining the minimum area required to be landscaped. Lots of up to 10,000 square feet must have a minimum of one shade tree in each front yard. Larger lots must have a least two trees in each front yard, at least one of which is a shade tree; "the use of evergreen trees in conjunction with shade trees is encouraged."

One tree and ten shrubs are required for every 550 square feet of landscape in right-of-way areas.

An exception to the above rule is that the right-of-way on local streets with detached walks must have one tree every 80 feet.

This section also lays out who is responsible for right-of-way area maintenance.

B. Single-Family Attached and Multi-Family Residential

This section begins with the minimum area required to be landscaped. One tree and three shrubs must be planted for every 550 square feet. All other requirements are similar to the requirements for Single-Family Detached Residential areas.

VIII. Right-of-Way Landscape Standards

Westminster states that "right-of-way requirements apply to developments of all types of land use" and are the responsibility of the adjacent property owner.

The reader is referred to the regulations for Single-Family Detached Uses for plant material requirements.

IX. Parking Lot Landscape Standards

The City states that "parking lots within any land use category are required to be landscaped." The minimum design considerations are listed. Those concerning trees are the same as the requirements for Single-Family Detached Uses. Shade trees are encouraged.

X. Non-Residential Landscape Standards

These regulations apply to commercial, office, industrial, religious, institutional, non-profit, government, and public projects uses.

Trees are encouraged adjacent to buildings and throughout the landscaped area.

"The entrances to commercial or industrial centers should be designed to provide an attractive, year-round landscape statement. Medians/landscape islands are encouraged at entranceways… The addition of large trees, especially evergreens, can provide an all-season backdrop, and direct attention to the sign feature area."

One tree and three shrubs must be planted for every 550 square feet of landscaped area.

XI. Landscape Regulations Chart

This section is made up of a chart with the landscaping requirements for the various land uses referred to above.

XII. Landscape and Irrigation Plan Requirements

This section outlines who needs to submit landscape and irrigation plans, how to submit them, how to amend a plan, and what the information needed to be included in the plans. Elements required to be incorporated into the plans concerning trees include:

- Natural features relevant to the site
- Proposed hydrozones
- Areas to be irrigated with potable or non-potable water
- Total water budget and calculations by hydrozone
- Existing plant material, including plants to be removed or relocated
- Plant schedule
- Plant names and quantities of each plant
- Size of plants
- Plant spacing

The rest of this section outlines all of the irrigation plan requirements.

XIII. Plant Material List by Hydrozone

This section states that a list of plant materials by suggested hydrozone placement is available through the Planning Division. See Appendix A.

XIV. Landscape Maintenance Requirements

Any modification made to existing landscape areas requires City approval. The regulations say that all landscapes must be continually maintained including irrigation, weeding, pruning, and replacement. Tree 'survival standards' are listed below.

- Trees must have a 100 percent ongoing survival rate.
- Dead or damaged plants must be replaced.
- Pruning should not drastically alter the natural growth pattern or mature size of a tree.
- Insect-infested or disease-infected trees must be treated or removed.

XV. Private Improvements Agreement

This is a written agreement between the property owner and the City that includes the proposed landscaping, irrigation, and projected costs plus the regulations governing the agreement.

XVI. Definitions

This section contains definitions of terms used in the regulations.

Model Ordinances: City of Westminster

I. Statement of Intent
The City of Westminster recognizes landscaping as an important component of quality development, resulting in the enhancement of Westminster's character and image as well as providing benefits to the public such as, but not limited to

- Improvement of air and water quality
- Reduction of heat, glare, dust, and noise
- Provision of wildlife habitat and living environment
- Efficient use of water resources

V. Considerations in Landscape Design
…the following landscape elements must be considered and incorporated into the landscape and irrigation design.

A. Water Conservation/Water-wise Landscaping/Xeriscaping

1. Xeriscape

- Design – zones of different water requirements… hydrozoning.
- Irrigation – watering deeply and less frequently will typically result in plants that are deeper rooted and more drought-tolerant.
- Mulch – covers bare soil, reducing evaporation, soil temperature, and erosion.

- Use of low water plants – Careful plant selection and grouping based upon water requirements, with the goal of conserving water…

2. Specific Water-wise Landscape Elements
In order to reduce the impact of drought on landscapes and provide efficiency in the use of water, landscape design will be required to incorporate various water-wise elements. These are as follows:

- Hydrozoning
- Total annual water application by irrigation (water budget) shall not exceed 15 gallons per square foot per year (24 inches)
- …in times of plant establishment or drought, these low water use plants benefit from controlled, supplemental watering
- Moderate hydrozones
- High hydrozones
- …for purposes of water conservation, it is desirable to transition to a low water zone adjacent to paved areas
- Automatic irrigation systems will be required in all landscape areas and must be installed prior to plant materials. The design of the irrigation system must reflect hydrozones and various requirements within these regulations
- Soil preparation
- Mulching in all non-turf areas of the landscape area is required. Because organic mulches (such as bark) assist in retaining soil moisture and reduce heat absorption and reflection, organic mulches will be required in moderate and high hydrozones
- Plant selection and location will be required to match the plants' water needs to the appropriate water zone. This design practice enhances the efficient use of water and increases the survival rate and health of plants by reducing over-watering or under-watering of plants

D. Plant Selection and Design

Planting trees on both sides of the sidewalk is required in order to create a canopy effect and to provide areas of shade for the pedestrian.
Use of non-potable water will require plant selection tolerant of higher salt and potassium levels.

G. Medians, Landscape Islands, and Landscape Adjacent to Hardscape

Planting area height (including mulch)…shall be level to or below the surrounding hardscape or curbing to minimize water runoff and enable proper maintenance.

VI. General Landscape Provisions for Plant Materials and Their Design and Installation

The Standards in these regulations are to be considered as minimum requirements. Developers/owners are encouraged to increase the size and/or quantity of plant materials whenever possible.

The owner of a project is required…to determine the proximity of the project to the City's non-potable water system and the feasibility of tying into this system.

A. Trees
Long-living shade trees…are preferred
Trees should be located to provide summer shade and limit winter shade on walks and streets. Periodic winter watering is typically necessary in Colorado due to periods of dryness.
All trees must be surrounded by an area of mulch of no less than 2 feet from the trunk and 4 feet in diameter, and no less than 3 inches in depth. It is recommended to periodically increase the mulch ring to the size of the drip line of the tree. This encourages root development and conserves water.

IX. Parking Lot Landscaping Standards
(B) Plant Materials
Shade trees are encouraged within and adjacent to parking lots for provision of shade and relief from heat during summer months.

XII. Landscape and Irrigation Plan Requirements
B. Irrigation Plans

- Irrigation design and techniques must correspond to the hydrozone and type of plant material.
- Avoid overspray onto non-landscaped areas.
- Total annual water application by irrigation (water budget) shall not exceed an average of 15 gallons per square foot per year to facilitate water conservation. For purposes of calculating the water budget, the low hydrozone is calculated as 3 gallons per square foot per year; the moderate hydrozone calculated at 10 gallons per square foot per year; and the high hydrozone calculated at 18 gallons per square foot per/year.
- Requirements of water features must be indicated as part of the water budget and will be evaluated on a case-by-case basis. The water used in water features must be recycled. Non-potable water must be used if possible. Water features must be maintained in working order and operate during the times specified in the Official Development Plan.
- A maximum irrigation time limit of eight hours every other day.
- Use of a master shut-off valve to shut off water to the system when not operating in order to reduce leakage of water from the system.
- Irrigation time clock controllers shall have the capability of allowing for seasonal adjustments, including global water budget controls. All controllers shall allow for multiple programs and start times…shall use evapotranspiration or soil moisture-based programming, including either local sensors, remote, or historic evapotranspiration-based scheduling or soil moisture sensors.
- Use of automatic rain shutoff devices.
- Irrigation using non-potable water should investigate the use of potable water for trees and shrubs.

XIII. Plant Material List by Hydrozone

Factors such as dramatic temperature changes over short periods of time, wind, soil, slope, exposure, moisture, and other environmental and maintenance factors can affect the hardiness and health of plant material.

XIV. Landscape Maintenance Requirements

- All living plant material…must be maintained in perpetuity.
- All plant material including trees, shrubs, groundcovers, vines, and turf must have a 100 percent ongoing survival rate.
- Irrigation should not occur in the heat of the day in order to reduce evaporation. Excessive water run-off, as determined by the City, is not permitted
- Irrigation systems shall be maintained and periodically adjusted to assure watering efficiency and conservation methods.

The Town of Castle Rock
Landscape Regulations and Principles

Castle Rock, located 30 miles south of downtown Denver, has a population of around 35,000. It relies on aquifer withdrawals to supply water to its citizens (Town of Castle Rock 2006). The Town of Castle Rock's (the Town) Landscape Regulations and Principles are online at http://www.ci.castlerock.co.us/Page.asp?NavID=525.

Castle Rock adopted the following regulations in 2003 to "encourage the use of water-conserving landscapes." Any non-residential or residential builders and multi-family developments are required to have their landscape plans approved before installation. Requirements for homeowners are not affected by these regulations (except for the public right-of-way).

Governing commercial, streetscape, and park areas, these regulations emphasize landscapes that complement the use of the site under development. "Landscape design should relate to a site analysis with an emphasis on proper plant material, soil preparation, and irrigation system design. The overall landscape must consider the seven principles of xeriscape (emphasis added)."

Water-wise design is required for all new residential development. While the use of Bluegrass in not prohibited entirely, the regulations emphasize the functionality, attractiveness, and water efficiency of the landscape overall.

The regulations and principles are presented in eight sections:

1. Executive Summary
2. Introduction
3. Landscape Regulations
4. Landscape Principles
5. Registration of Landscape Professionals
6. Water Conserving Plants
7. Forms/Specification Details
8. Appendices

1. Executive Summary

The Town of Castle Rock is taking a holistic approach to water conservation. The conclusion of the Executive Summary states that:

> Castle Rock is in a unique position that allows it to develop water-wise practices as a Town value that is integrated into the lives of its residents and businesses. These Landscape Regulations lay the groundwork to eliminate the need for restrictive water policy, and instead create a water-conserving solution that becomes ingrained in the culture of the community.

The Executive Summary begins with the startling statistic that "In 2002, 96 percent of the water used for all purposes in the Town of Castle Rock came from Denver Basin aquifers." It notes that while the aquifer supply seems limitless, it is actually finite and nonrenewable.

Castle Rock, like other Front Range communities, has a booming population that could double by the year 2020. Residents use an average of 184 gallons of water each day. The Town of Castle Rock presents the economic argument that the cost of purchasing new supplies of water will increase, and therefore, any water saved via conservation measures signifies money saved for taxpayers. At current market rates, groundwater is $2,000 per acre foot, and surface water is $10,000 per acre foot, excluding the cost of the infrastructure needed to transport and treat the water.

Castle Rock is "creating a community culture that embraces water conservation and smart watering practices, xeric design, and efficient irrigation techniques" in order to ease the effects of projected demand, higher rates, and threatened aquifers. The Town sees these regulations as an opportunity to lead other Front Range communities in the implementation of water-conserving landscapes, capitalizing on natural topography, while respecting property owners' rights.

The regulations outline existing codes, lay out the process for the different classifications of land use, and conform to other documents that govern water use, resource management, parks, and public works regulations.

The Executive Summary closes by delineating how the regulations apply to nonresidential, residential, and preexisting landscapes.

The Town of Castle Rock incorporates commercial, streetscapes, and parks into the nonresidential use category; and the regulations focus on utility of the site.

The goal for residential landscape design is to take advantage of the unique land while also meeting the family's desires. Water-wise design is required. Homeowners changing their landscape can look to the Town for assistance in installing a "functional, attractive, and water-efficient landscape." Multifamily developments will take into consideration the uses of the landscape. Preexisting landscapes are to be considered on a case-by-case basis with incentive programs to encourage the adoption of xeric principles.

2. Introduction

2.1 Intent of Regulations

The goals that the Town of Castle Rock has identified for its landscaping are

- To lose the need for seasonal demand management measures
- To reduce annual water consumption in accordance with the Water Conservation Plan
- To conserve water via design, installation, and maintenance
- To maintain and enhance Castle Rock's unique landscape characteristics
- To promote water conservation via public education and incentive-based programs

2.2 Definitions
This section of the introduction defines terms used in the regulations and principles.

2.3 Application of Regulations
This section states that these regulations and principles "apply to all land, public, institutional, and private, located within the Town of Castle Rock" and specifically apply to (emphasis added)

- New development
- Approved plans
- Construction projects
- Any land use change
- Areas with multiple land uses

2.4 Violations and Penalties
Anyone who violates the regulations and principles will be fined not more than $1,000 or imprisoned for not more than one year.

3. Landscape Regulations

3.1 Landscape Plan General Requirements
This section outlines what is required to be submitted for approval including format, contact information, and components of the plan such as cardinal directions, property lines, etc. In general, all plans must depict boundaries of floodplains and drainage channels as well as wooded areas or other natural features within the property and 100 feet adjacent to the property.

Residential properties include front yards, back yards, side yards, common areas, and parking areas for single-family, two-family, and multi-family land uses.

3.2 Residential Properties
3.2.1 Multi-family Properties
The documents required for submittal are different depending on the type of land use or development being proposed. The regulations tabulate what is needed for each use.

Minimum landscape requirements are addressed after all of the procedures are delineated. The regulations require that drought-tolerant turf be used where turf is permitted, unless a more resilient turf is suitable for the land's purpose, such as a playing field. Irrigated turf cannot be installed on slopes steeper than a 3:1 grade, and no more than 60 percent of the total landscaped area can be irrigated turf.

The regulations require that all plant materials utilized be drought-tolerant and listed in Section 6 (see Appendix A). The following are minimum landscaping requirements.

- Any parking areas must have 10 percent landscaping. Any parking area in a multi-family use development must incorporate interior landscape islands containing one tree and four shrubs per island.
- Generally, any parking areas must plant two shade trees and four shrubs for every 1,000 square feet of landscaped area.

- At least 20 percent of the total development site, which includes setbacks and buffers, must be landscaped.
- Ornamental mulch is discouraged; however, if it is used, it should be placed around trees and shrubs that are tolerant of hot and dry conditions.
- Deciduous trees must be at least 2 inches in caliper, measured 4 inches above ground, except for ornamental or flowering trees which must be at least 1.5 inch caliper.
- Coniferous trees must be at least six feet tall.
- Organic mulch must be applied at a depth of 4 inches.

Minimum soil preparation and irrigation system requirements are also addressed in this section. Any landscaped area over 5,000 square feet requires an automatic irrigation system.

3.2.2 Developer/Builder Single and Two-Family Residential Properties

This section covers single and two-family attached residential units. All elements of design, plant selection, soil preparation, and irrigation system installation and maintenance of these units must be in accordance with Section 4.

The documents required for submittal are different depending on the type of land use or development being proposed. The regulations tabulate what is needed for each use.

- Site analysis must comply with 4.2.1.
- Landscape design must comply with 4.2.
- Landscape material must comply with 4.2.2.
- Mulch must be applied to a depth of 4 inches.
- Maximum turf percentages are outlined and depend upon square footage.
- All plant material must be drought-tolerant and selected from Section 6.

These are other minimum landscaping requirements for single-family units.

- There must be one tree in the front yard setback.
- Deciduous trees must be at least 2 inches caliper; ornamental and flowering trees must be at least 1.5 inch caliper.
- Coniferous trees must be at least 6 feet tall.

Soil preparation must comply with Section 4.2.3.

Acceptable organic materials are aged compost, wood humus from non-toxic trees, sphagnum moss (not Colorado's), and aged or treated manures.

This section concludes with minimum irrigation system requirements.

3.2.3 Residential Properties – Homeowner installations

This section applies to landscape work done by owners of single and two-family dwellings. Again, the documents required for submittal are tabulated. The regulations recommend consideration of plant and mulch materials as outlined in Section 4.2.2. Minimum soil preparation and irrigation system requirements are also outlined.

3.3 Non-Residential Properties
These regulations govern front, back, and side lots of commercial areas, parking areas, and Town facilities.

3.2.1 Multi-family Properties
This section outlines the administrative process and the documents needed for landscape plan approval.

3.3.2 Commercial Properties
This section governs commercial, business, and industrial land use development and states the minimum design criteria:

- Site analysis in accordance with Section 4.2.1
- Use analysis in accordance with Section 4.2.1
- Site Plan in accordance with Section 4.2.1
- Application of xeriscape principles as defined in Section 4.2
- Parking lot requirements

The regulations require that drought-tolerant turf be used where turf is permitted, unless a more resilient turf is suitable for the land's purpose, such as a playing field. Irrigated turf cannot be installed on slopes steeper than a 3:1 grade, and no more than 60 percent of the total landscaped area can be irrigated turf.

The regulations require that all plant materials utilized be drought-tolerant and listed in Section 6 (see Appendix A).

3. Parking Lot Landscaping Requirements

- Ten percent of the total parking lot area shall be landscaped.
- Lots comprising of more than 75 spaces or four rows shall require interior landscape islands with raised curbs and must contain at least one tree and four shrubs. One tree can replace the four-shrub requirement.
- Lot landscape areas shall contain a minimum of two trees and four shrubs per 1000 square feet of landscaped area.
- Lot landscaping shall be included in the overall site requirement.
- Lot islands shall have a minimum six-foot horizontal dimension.

4. Other Minimal Landscape Requirements

- At least 10 percent of the gross site area must be landscaped.
- Up to 25 percent of landscaping can be non-living ornamental materials.
- At least two trees and four shrubs must be planted per 1000 square feet of landscaping area.
- Deciduous trees must be at least 2 inch caliper, except for ornamental and flowering trees; multi-trunk trees shall have at least three canes.
- Coniferous trees must be at least 6 feet tall.

Minimum soil preparation and irrigation system requirements are also outlined.

3.3.3 Public Buildings

Public buildings encompass properties owned and operated by the Town and do not include designated parks, open space, or other irrigated areas.

3.3.4 Large/Common/Public Irrigated Areas

These regulations govern large, common, and irrigated public areas over 20,000 and managed by the same group or individual. Minimum design requirements include:

- Site analysis in accordance with Section 4.2.1
- Use analysis in accordance with Section 4.2.1
- Site Plan in accordance with Section 4.2.1
- Application of xeriscape principles as defined in Section 4.2
- Designated tap for irrigation

The regulations require that drought-tolerant turf be used where turf is permitted, unless a more resilient turf is suitable for the land's purpose, such as a playing field. Irrigated turf cannot be installed on slopes steeper than a 3:1 grade, and no more than 60 percent of the total landscaped area can be irrigated turf.

The regulations require that all plant materials utilized be drought-tolerant and listed in Section 6.

These are other minimum requirements.

- Use of ornamental rock mulch is discouraged.
- Organic mulches should be applied at a level of one cubic yard per 80 square foot area at a depth of 4 inches.
- Deciduous trees must be at least 2 inch caliper, except ornamental or flowering deciduous trees.
- Coniferous trees must be at least 6 feet tall.

Minimum soil preparation and irrigation system requirements are also outlined.

This section also touches upon streetscapes. Tree regulations in this section are included below.

- Trees shall not be planted closer than 30 feet from the curb at intersections.
- No plant material over 30 inches is allowed within the sight triangle.
- Trees must not interfere with visibility of traffic control devices.
- Trees should be located a minimum of 42 inches from the curb.
- For commercial areas, trees must be at least 20 feet from streetlights.
- A clear walking distance between trees and buildings of 10 feet is required.
- Trees shall not be planted within 5 feet of a utility.

Tree size in streetscapes should be as follows:

- Trees should be large enough when planted to provide substantial shade.
- Trees in grates shall be 3 inches caliper.
- Trees in tree lawns shall be 2 inches caliper.

- Tree branch height on the traffic side of the street must be at least 13 feet and 6 inches.
- Tree branch height on the pedestrian side of the street must be at least 8 feet.
- Small thornless and fruitless trees may only be used in medians where they do not interfere with visibility.
- Small trees should be planted where a large tree could not reach maturity without severe pruning.

The public right-of-way, whether residential or commercial, shall be maintained by the adjacent property owner, in compliance with the planned development site landscape plan regulations herein.

4. Landscape Principles

4.1 Policy Information

The Town of Castle Rock begins this section by recognizing that

- Colorado is a semi-arid state, with an average of 13 inches of precipitation a year, and that currently 50 percent of annual water production is used in landscape irrigation.
- Castle Rock has a unique natural identity and environment, with the ecological and aesthetic contribution of landscape design, installation, and maintenance.
- "Conserved water is a viable water resource, and demonstrates that water conservation is a core value of the organization." (emphasis added)

Castle Rock's goal is to implement programs that consider both environmental qualities, the quality of life of its residents and business owners, and practicality.

4.2 Landscape Principles

The regulations state that landscaping design, installation, and maintenance shall promote

- Water conservation
- Compatibility with the indigenous environment
- Best management practices specific to the locale
- Creative design solutions that contribute to the unique character of the community

The steps involved in such a 'water-wise' landscape are the same as the seven xeriscape principles and include:

Planning and Design	Plan addresses site's characteristics, property owner's needs, and the best methods for water conservation
Soil Evaluation and Improvement	Good soil, which incorporates organic matter – the basis of a successful, water-conserving landscape
Creation of Practical Turf Areas	Turf, which is a high-water consumption element, limited to areas where it serves a purpose
Appropriate Plant Selection	Selecting plants adapted to Castle Rock's climate and soils, grouping them by their water needs, and appropriate placement, all contributing to a water conserving landscape
	Grouping plants according to their water needs,

Efficient Irrigation	choosing wise irrigation methods, and watering efficiently
Use of Mulches	Mulching reduces water evaporation from the soil, buffers the daily soil temperature, and discourages weed growth
Proper Maintenance	Proper fertilization, weeding, watering, and other maintenance will ensure a landscape resistant to disease and drought while conserving water

The regulations delve more deeply into each of the seven steps of a 'water-wise' landscape below.

4.2.1 Planning and Design

Incorporated within the first Xeric design principle, Castle Rock expects landscape plans to minimize water use and provide a buffer between diverse land uses. Within the "Planning and Design step, there are sub-steps listed as follows:

1. Site Analysis – This is an inventory and analysis of the site and its features, including factors such as wind, exposure, topography, drainage, existing features, and views. The analysis must also take local zoning and construction codes concerning utility easement and site distance requirements into consideration.
2. Use Analysis – This step identifies the site's use and the material best suited for the site, including the overall theme and adjacent properties.
3. Site Development – The site and use analyses are considered with the overall development goals for the property.
    a. Design elements are plants, structures, turf alternatives, irrigation, grading and contouring, soil, and other special features such as lights and re-circulating fountains.
    b. Landscaping shall be integral to the overall site design, enhancing any buildings, views, and buffers.
    c. "Where a site abuts a natural amenity such as a floodplain, trail corridor, park, or other open space, the landscape plan should complement the natural character and integrity of the amenity."

4.2.2 Landscaping Material

Plan materials utilized should be in compliance with the criteria outlined in Section 3 and should also consider:

- Mature height, spread, shape, and form of a plant
- Attraction of wildlife
- Soil moisture requirements
- Aesthetic elements
- Proper plant care and maintenance

Castle Rock inserts this special note: "Non-native species and other typically 'non-xeric' plant material may be practical for some landscape designs, dependent on land use and individual site characteristics."

The regulations also request that plant material quality parameters meet the Colorado Nursery Act and the American Standard of Nursery Stock standards.

Non-living plant material is cited for protecting the soil from moisture loss.
Organic mulches, which could be wood, bark, chips, pine needles, cones, sticks, straw, leaves, and grass clippings, should be employed to

- Reduce surface evaporation
- Improve water penetration and air movement
- Control soil temperature fluctuations
- Protect shallow-rooted plants from freeze damage and frost-heave
- Discourage weed growth
- Improve soil structure and nutrient availability

The minimum installation criterion for organic mulches is that they be applied at a level of one cubic yard per 80 square foot area at a depth of 4 inches.

It is recommended that mulch be applied to bare soil with edging around the area, that the mulch be top-dressed as a result of decay breakdown every other year, and if metal edging is used, that it be either rolled or capped. Non-organic mulch or decorative rock is more formal, does not decompose, and may draw heat. Inorganic mulch includes gravel, boulders, and decorative rock.

4.2.3 Soil Preparation

Soil composition, texture, and fertility vary throughout Castle Rock and are primarily sand, silt, and clay. Proper soil preparations yield the following benefits:

- Loosens clay soils
- Allows air and water to circulate within the soil
- Allows organic matter to retain water in sandy soil
- Stores nutrients for plants

Soil amendments should be based on analysis and incorporated into the soil, as described in this section.

4.2.4 Irrigation Systems
The regulations state that irrigation has the greatest potential to impact water conservation. "According to Front Range experts, over-watering actually creates more problems than under-watering, and wastes up to 40 percent of the water being applied."

Three principles are defined to apply to water-efficient irrigation of landscapes:

- Different plans have different water requirements.
- Specific plants will have varying water needs, depending on size, location, and landscape.
- Plant and lawn water requirements change with the season, weather, the age of the plants, and previous watering methods. (emphasis added)

This section then describes the specifics needed in the irrigation plan.

4.2.5 Maintenance

The owner must keep landscaping neat, clean, and healthy. Maintenance includes pruning, mowing, weeding, and irrigation. A violation of these parameters will be considered a violation of code: upon written notice, an owner has six months to fix any damage. The regulations emphasize that "ongoing maintenance assists with not only maintaining pleasing aesthetics and functionality of landscapes, but also with maintaining water savings."

Maintenance includes:

- Watering
- Mowing
- Proper pruning
- Weeding and top dressing
- Aeration
- Fertilization
- Irrigation system maintenance

The regulations go into further detail on each of these aspects of landscape maintenance.

Watering must be done according to the Water Use Management Program. Precipitation shall not exceed 1.5 inches per week whether via rainfall or supplemental irrigation. Water should be applied to encourage maximum penetration and minimum runoff and evaporation. Water application should be appropriate for the soil type and shall be delivered at the most efficient time of day. Waste is not allowed.

5. Registration of Landscape Professionals

Landscape professionals and their plans must be registered with the Town of Castle Rock.

6. Water Conserving Plants

This section lists all of the plants, including trees, shrubs, and perennials, which are recommended for use in landscapes. Sources for the list include Colorado State University's Extension Service and the X-rated plant list from Garden Centers of Colorado. Substitutions are granted by the Director of Utilities. All plant material has to meet the standards set by the Colorado Nursery Act and the American Standard of Nursery Stock standards.

7. Forms/Specification Details

This section includes the forms needed for landscape plan approval.

8. Appendices

This section contains references to other related ordinances.

Model Ordinances: Town of Castle Rock

These landscape regulations…encourage the use of water-conserving landscapes… Rather than allowing drought-tolerant bluegrass throughout, landscape design should relate to a site analysis with an emphasis on proper plant material, soil preparation, and irrigation system design. The overall landscape must consider the seven principles of xeriscape. Water-wise design is required for new residential development, including proper soil preparation and irrigation design.

Section 2 - Introduction
2.1 Intent of Regulations
The Town of Castle Rock has identified goals to

- Move away from the need for implementation of seasonal demand management measures
- Reduce peak season and average annual water consumption in conformance with the Town of Castle Rock Water Conservation Plan
- Create conservation of water through water conserving design, installation, and maintenance of landscapes
- Promote water conservation through public education and incentive-based programs related to landscape installation and retrofit

The Landscape Regulations and Principles provide comprehensive water-efficient design standards…that balance quality of life with the overall responsibilities of the Town as a water provider.

Therefore, Landscape Regulations provide the following:

- Conservation of water resources through the use of water-conserving landscape principles and techniques.

Section 3 – Landscape Regulations
3.2 Residential Properties
B. Minimum Design Requirements
5. Water service for landscape irrigation shall be supplied by a tap used solely for the purpose of irrigation.

C. Minimum Landscape Material Requirements
2. Other Plant Materials
All trees, shrubs, and groundcovers shall be drought-tolerant/water-conserving plant materials.

3.2.2 Developer/Builder Single and Two-Family Residential Properties
C. Minimum Landscape Material Requirements
4. Other Plant Materials
All trees, shrubs, and groundcovers shall be drought-tolerant/water-conserving plant materials.

3.3.2 Commercial Properties
2. Other Plant Materials
All trees, shrubs, and groundcovers shall be drought-tolerant/water-conserving plant materials.

3.3.4 Large/Common/Public Irrigated Areas
5. A tap used solely for the purposed of irrigation shall supply water service for landscape irrigation.
2. Other Plant Materials
All trees, shrubs, and groundcovers shall be drought-tolerant/water-conserving plant materials.

Section 4 – Landscape Principles
4.1 Policy Information
The Town of Castle Rock recognizes
Conserved water is a viable water resource and demonstrates that water conservation is a core value of the organization.

4.2 Landscape Principles
Landscaping design, installation, and maintenance shall promote water conservation.

Steps to a water-wise landscape include:
1. Planning and Design
   Developing a plan that addresses the physical site characteristics, the needs of those using the property, and the best water conserving methods is the most important step in creating a successful landscape.
2. Soil Evaluation and Improvement
   Good soil is the basis for all successful water-conserving landscapes. Both short and long-term, landscapes benefit from incorporating organic matter.
3. Creation of Practical Turf Areas
   Turf grasses are high water-consuming plants. Limiting turf grass to areas where it serves a purpose can substantially reduce water consumption.
4. Appropriate Plant Selection
   Selection of plants that are better adapted to Castle Rock's climate and soils, grouping them according to their water needs and then placing them in locations favorable to their growth results in healthier, easier-to-maintain landscapes that use less water.
5. Efficient Irrigation
   Grouping plants according to water needs, choosing irrigation methods that water each plant efficiently, and regulating irrigation systems to water adequately is a major component of water-conserving landscaping.
6. Use of Mulches
   Mulching of planting beds reduces water evaporation from the soil, buffers daily soil temperature fluctuations, and discourages weed growth.
7. Proper Maintenance
   Proper fertilization, weeding, watering, and other maintenance encourages a beautiful landscape that is disease-resistant, survives drought conditions, and saves water.

4.2.1 Planning and Design

The landscape plan shall be designed to minimize water use through the use of water-efficient landscape principles.

4.2.4 Irrigation Systems
Irrigation has perhaps the greatest potential to affect water savings than any other component of the water-conserving landscape. According to Front Range experts, over-watering actually creates more problems than under-watering, and wastes up to 40 percent of the water being applied.

Three principles apply to water-efficient irrigation…
- Different plants have different water requirements.
- Specific types of plants will have varying water needs depending on age, size, and location in the landscape.
- Plant or lawn areas will have water requirements that change with the season, weather, the age of the plant, and the previous watering methods.

A. General Plan Criteria
3. The irrigation plan shall note hydrozones and shall take into account like water demand plants, slopes, microclimates, environmental factors, and water pressure.
4. Irrigation system standards shall
c. Ensure that service connection, whether combined with domestic or irrigation only, can meet irrigation demand requirements, consistent with the Town of Castle Rock Landscape Regulations, Water Use Management Program, and other applicable codes and policies through inclusion of projected water demand for each of the following:
- Monthly watering during the typical growing season (April-October), based on typical evapo-transpiration and precipitation data for each month.
- Winter watering after establishment

6. Irrigation design shall address:
a. Date and time of watering, consistent with Water Use Management Plan criteria
b. Separate zones for different equipment or water requirements based on exposure, plant selection, and slope
i. Total application rate per zone shall be provided, shall not exceed 1.5 inches per week precipitation, and shall not exceed 1 inch per day.
j. Eliminate over-spray and application of water to impervious surfaces.
q. Moisture/rain-sensing device installed for automatically controlled system,

4.2.5 Maintenance
A. Maintenance Principles
Ongoing maintenance assists…with maintaining water savings.

6. Water waste is not allowed.

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Prepared by:
Desirée Thorp
Senior Project Intern

Institute for Environmental Solutions
761 Newport Street
Denver, CO 80220-5554
www.I4ES.org

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