Model Regional
Water Efficient Landscape and Irrigation Ordinance

Provided by
South Metro Water Supply Authority

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INTRODUCTION

Across the south metro Denver area, local communities are developing responsible public policy initiatives that address concerns over drought and availability of local water resources. Since its inception, the South Metro Water Supply Authority (SMWSA) and its 13 water provider members have worked together to develop new renewable supplies, to become leaders in water conservation and efficiency in the state, and significantly reduce groundwater level depletions.

In 2014, SMWSA began investigating the benefits of a regional water conservation effort within its membership. Resoundingly, individual members stressed the importance of local, independently operated water conservation/efficiency plans and systems. Yet, there was also a strong desire for regional collaboration on larger-scale conservation projects, sharing of information and experience, potential for funding opportunities, and benefits from economies of scale through partnering. A Conservation and Efficiency Subcommittee comprised of SMWSA members, staff, and led by SMWSA was developed to implement these objectives.

In 2015, SMWSA partnered with Douglas County to identify outdoor water conservation and water efficiency efforts that can benefit the region as a whole and promote regional partnering, and to better understand the nexus between water and land use planning. The results of this investigation found that certain programs require land use authority, which many of the SMWSA members do not have. However, the concept of developing a regional water efficient landscape and irrigation ordinance (or regulation) was broadly recommended by SMWSA as well as Douglas County, with the directive to provide a comprehensive set of water efficient landscape and irrigation standards developed with the south metro Denver area's hydrologic and climate conditions in mind. Individual jurisdictions of water and land use authority will impact a local entity's ability to include (or omit) certain elements of the broader standards.

This Model Regional Water Efficient Landscape and Irrigation Ordinance was produced by the SMWSA Conservation and Efficiency Subcommittee with the assistance of Element Water Consulting. It incorporates aspects of other existing and model landscaping regulations and standards[1] as well as the experience of the SMWSA membership organizations. The intent is to support, not supersede, other existing landscape and irrigation water conservation programs. The *Water Efficient Landscape and Irrigation Checklist* provided below includes the minimum recommended components of the model ordinance, based on the experience of local water efficiency experts, to provide consistency and clarity in best management practices across the south metro Denver area.

The model ordinance is not intended as a required set of regulations. It has been prepared as a comprehensive menu of best management practices, and local entities should seek input from local water and land use officials in determining which components can be implemented and enforced in their own local regulations or ordinances. This was developed to be used within the south metro Denver region as a reference document and tool for developing or modifying local landscape and irrigation regulations and ordinances as desired by each local entity. Benefits for use of this document by local entities include: 1) more regional consistency between SMWSA members for more effective work with

[1] Referencing include: Town of Castle Rock Landscape and Irrigation Performance Standards and Criteria Manual, Office of Smart Growth in the Colorado Department of Local Affairs (DOLA) *Water-Efficient Landscape Design* model ordinance and best practices manual, California's Model Water Efficient Landscape Ordinance, and the Irrigation Association's Model Irrigation Ordinance.

new development contractors; 2) locally vetted and focused landscape and irrigation practices for the south metro Denver climate; and 3) a resource for all members to enhance or develop local regulations if internal resources to develop such a tool are otherwise not available.

When adding any of the included sections to a local ordinance, the implementation procedures should be refined for consistency with the local entity's existing procedures and regulations, e.g. if the entity has land use authority, then the implementation could occur through the building permit process and there may be a minimum threshold project size for which it applies. The model ordinance was drafted for this situation, where the regulating entity or "local agency" is separate from the water provider. **If the regulating entity is a water provider but has no land use authority, the regulations could be implemented through the water service commitment process (e.g. tied to water taps and system impact fees) in which case references to the "local agency" and permitting procedures should be updated to reflect the specific permitting procedures. Portions of the model ordinance that may need to be updated to reflect this situation are identified with an asterisk (*).** Under this circumstance, the water budgeting aspects of this regulation could also be integrated with the water rate structure. Certain pieces of the model ordinance could also be implemented through a voluntary incentives-based program (e.g. the Maximum Applied Water Budget could be optional, with the opportunity for project applicants to obtain a lower water dedication requirement or system impact fee through adhering to a certain water budget).

This model ordinance is written to apply primarily to new construction. To maintain post-construction water savings, local agencies can prevent water waste resulting from inefficient landscape irrigation on *existing* landscapes by prohibiting runoff from leaving the target landscape due to low-head drainage, overspray, or other similar conditions where water flows onto adjacent property, non-irrigated areas, walks, roadways, parking lots, or structures. Penalties for violation of these prohibitions shall be established locally.

Similarly, education is a critical component to promote the efficient use of water in landscapes. Local agencies should provide information and resources to customers regarding the design, installation, management, and maintenance of water efficient landscapes.

WATER EFFICIENT LANDSCAPE AND IRRIGATION CHECKLIST

The Water Efficient Landscape and Irrigation Checklist forms the basis of the Model Regional Water Efficient Landscape and Irrigation Ordinance. It emphasizes the minimum recommended components of the model ordinance, based on the experience of local water efficiency experts, to provide consistency and clarity in best management practices across the south metro Denver area.

For more information on these and other planning and land use publications, visit the SMWSA website at http://southmetrowater.org or call 720-216-5158.

LANDSCAPE CRITERIA	
	Soil amendment and preparation (Section 5.1).
☐	Minimum of 4 cu. yds. organic matter soil amendment per 1,000 sq. ft. landscaped area, tilled to minimum depth of 6 inches.
	Mulch (Section 5.2.1).
☐	Organic mulch applied at 1 cu. yd. per 80 sq. ft. at depth of 4 inches.

IRRIGATION SYSTEM CRITERIA	
	Irrigation System Requirements (Section 6.1).
☐	Master shut-off valves and flow sensors, integrated with the automatic irrigation controller.
☐	Dedicated landscape water meters for all non-residential irrigated landscapes.
☐	Sensors that suspend or alter irrigation operation during unfavorable weather conditions or when sufficient soil moisture is present.
☐	6-inch minimum pop up height in turf areas is required for all spray heads and rotors.
☐	Pressure-regulating devices shall be installed to meet the required operating pressure of the emission devices.
☐	Design of the irrigation system shall conform to the hydrozones of the landscape design plan.
☐	Sprinkler spacing must achieve head-to-head coverage.
	Hydrozone Requirements (Section 6.2).
☐	Areas less than ten feet in dimension shall not utilize overhead sprinkler irrigation.

MODEL REGIONAL WATER EFFICIENT LANDSCAPE AND IRRIGATION ORDINANCE

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MODEL REGIONAL WATER EFFICIENT LANDSCAPE AND IRRIGATION ORDINANCE

1. PURPOSE AND INTENT

The purpose of this ordinance is to protect and enhance the community's environmental, economic, recreational, and aesthetic resources by promoting efficient use of water in the community's public and private landscapes, reducing water waste, and establishing procedures for the design, installation, and maintenance of water-efficient landscape and irrigation systems throughout the jurisdiction.

1.1 Objective

_____ has found:

1.1.1 The waters of _____ are of limited supply and are subject to ever increasing demands.

1.1.2 The continuation of _____'s economic prosperity is dependent on the availability of adequate water supplies for future uses.

1.1.3 It is the policy of _____ to promote the conservation and efficient use of water and to prevent the waste of this valuable resource.

1.1.4 Landscapes are essential to the quality of life in _____ by providing areas for active and passive recreation and as an enhancement to the environment by cleaning air and water, preventing erosion, offering fire protection, and replacing ecosystems lost to development.

1.1.5 Landscape design, installation, maintenance, and management can and shall be water efficient.

1.2 Purpose

Consistent with these findings, the purpose of this ordinance is to:

1.2.1 Promote the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible.

1.2.2 Establish a structure for planning, designing, installing, maintaining, and managing water efficient landscapes in new construction and rehabilitated projects.

1.2.3 Establish provisions for water management practices and water waste prevention for existing landscapes.

1.2.4 Use water efficiently without waste by setting a Maximum Applied Water Budget as an upper limit for landscape water use and reduce landscape water use to the lowest practical amount.

1.2.5 Promote the benefits of consistent landscape ordinances with neighboring local and regional agencies.

1.2.6 Encourage local agencies and water purveyors to use economic incentives that promote the efficient use of water, such as implementing a water budget.

1.2.7 Encourage local agencies to designate the necessary authority that implements and enforces the provisions of this Model Water Efficient Landscape and Irrigation Ordinance or its local landscape ordinance.

2. APPLICABILITY AND GENERAL REQUIREMENTS

2.1 Applicability

After _____(date), this ordinance shall apply to all of the following landscape projects:

2.1.1 New construction and rehabilitated landscapes for public agency projects and private development projects.

2.1.2 New construction and rehabilitated landscapes which are developer-installed in single-family and multi-family projects.

2.1.3 New landscape installations which are homeowner-provided and/or homeowner-hired in single-family and multi-family residential projects.

2.1.4 Applicability to existing landscapes (e.g. criteria for remodels or renovated landscape greater than a minimum area) should be determined by the local entity.

2.2 Exceptions

This ordinance does not apply to:

2.2.1 Registered local, state, or federal historical sites.

2.2.2 Ecological restoration projects not requiring a permanent irrigation system.

2.2.3 Mined-land reclamation projects not requiring a permanent irrigation system.

2.3 Enforcement*

Note to local entities: Enforcement of this ordinance is the responsibility and at the discretion of the local entity. Enforcement may include inspections, audits, integrating aspects of the ordinance with the water rate structure, and other procedures that should be determined at the local level. For example, the local entity may choose to hold a series of inspections (e.g. pre-construction meeting, meter set/point of connection inspection, soil inspection, final site compliance inspection, possibly one or more re-inspections to correct punch list items) which would be coordinated with other local permitting procedures.

3. DEFINITIONS

*** The model ordinance was drafted assuming that the regulating entity or "local agency" is separate from the water provider. If the regulating entity is the water provider, references to the "local agency" and permitting procedures should be updated to reflect the specific permitting procedures. Portions of the model ordinance that may need to be updated to reflect this situation are identified with an asterisk (*).**

Application rate: the depth of water applied to a given area, usually expressed in inches per hour.

Applied water: the portion of water supplied by the irrigation system to the landscape (supplemental to precipitation).

Automatic controller: a mechanical or solid state timer, capable of operating landscape irrigation stations and setting the schedule (days and length of time) for water application.

Backflow prevention device: a safety device used to prevent pollution or contamination of the water supply due to the reverse flow of water from the irrigation system.

Check valve or anti-drain valve: a valve located under, or incorporated within, a sprinkler head or other location within the irrigation system, to hold water in the system so it minimizes drainage from the lower elevation sprinkler heads when the system is off.

Certificate of Completion: the document showing the project has been installed and inspected according to the approved irrigation design plan.

Certified irrigation designer: a person certified to design irrigation systems by an accredited academic institution, Irrigation Association's Certified Irrigation Designer program, American Society of Irrigation Consultant's Professional Irrigation Consultant designation or other irrigation designer program labeled by U.S. Environmental Protection Agency's WaterSense program. The local entity will need to determine the acceptable certification criteria.

Certified landscape irrigation auditor: a person certified to perform landscape irrigation audits by an accredited academic institution, a professional trade organization or other program labeled by U.S. Environmental Protection Agency's WaterSense program. The local entity will need to determine the acceptable certification criteria.

Distribution uniformity: the measure of the uniformity of irrigation water over a defined area.

Ecological restoration project: a project where the site is intentionally altered to establish a defined, indigenous, historic ecosystem.

Emission device: a component of the system that disperses water to the landscape and includes sprinklers, bubblers, emitters, microsprays, etc.

Established landscape: the point at which plants in the landscape have developed roots into the soil adjacent to the root ball. Typically, most plants are established after one or two years of growth.

Establishment period: the first year after installing the plant in the landscape or the first two years if irrigation will be terminated after establishment. Typically, most plants are established after one or two years of growth. Native habitat mitigation areas and trees may need three to five years for establishment.

Evapotranspiration: the quantity of water evaporated from adjacent soil and other surfaces and transpired by plants during a specified time. See below for “reference ET”.

Flow meter or sensor: an inline device installed at or near the supply point of the irrigation system that produces a repeatable signal proportional to flow rate. Flow meters must be connected to an irrigation controller, or monitor capable of receiving flow signals and operating master valves. This combination flow meter/controller may also function as a landscape water meter or sub meter.

Flow rate: the rate at which water flows through pipes and valves (gallons per minute or cubic feet per second).

Graywater: untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. "Graywater" includes, but is not limited to, wastewater from bathtubs, showers, bathroom washbasins, clothes washing machines, and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers.

Hardscapes: a landscape feature that is made of any durable material (pervious and non-pervious).

Hydrozone: a portion of the landscaped area having plants with similar water needs that are served by a valve or set of valves with the same schedule. A hydrozone may be irrigated or non-irrigated. For example, a naturalized area planted with native vegetation that will not need supplemental irrigation once established is a non-irrigated hydrozone.

Infiltration rate: the rate of water entry into the soil expressed as a depth of water per unit of time (inches per hour).

Irrigation audit: an in-depth evaluation of the performance of an irrigation system conducted by a Certified Landscape Irrigation Auditor. An irrigation audit includes, but is not limited to: inspection, system tune-up, system test with distribution uniformity or emission uniformity, reporting overspray or runoff that causes overland flow, and preparation of an irrigation schedule. The audit shall be conducted in a manner consistent with the Irrigation Association’s Landscape Irrigation Auditor Certification program or other U.S. Environmental Protection Agency “WaterSense” labeled auditing program.

Irrigation efficiency: the measurement of the amount of water beneficially used divided by the amount of water applied. Irrigation efficiency is derived from measurements and estimates of irrigation system characteristics and management practices. Greater irrigation efficiency can be expected from well designed and maintained systems.

Irrigation Design Plan: the documents including the scaled drawing plan and any required forms showing calculations that are reviewed, approved and for which a permit could be issued.

Irrigation survey: an evaluation of an irrigation system that is less detailed than an irrigation audit. An irrigation survey includes, but is not limited to: inspection, system test, and written recommendations to improve performance of the irrigation system.

Irrigation water use analysis: a review of water use data based on meter readings and billing data.

Landscaped area: the entire parcel less the building footprint, driveways, non-irrigated portions of parking lots, hardscapes- such as decks and patios, and other non-porous areas. Water features are included in the calculation of the landscaped area. Areas dedicated to edible plants, such as orchards or vegetable gardens are not included.

Landscaping and/or landscape improvements: plantings of grass, shrubs, trees or similar living plants, with minimal use of other ground surface treatment such as decorative rock, bark, or stone. These inert materials are allowed to be used in conjunction with live material in planting beds, but do not count toward the calculations of required landscaping and/or landscaping improvements.

Landscape water meter: an inline device installed at the irrigation supply point that measures the volume of water into the irrigation system by using a flow totalizing device to record water use.

Lateral line: the water delivery pipeline that supplies water to the emitters or sprinklers from the valve.

Local agency*: a city or county that is responsible for adopting and implementing the ordinance. The local agency is also responsible for enforcement of this ordinance, including but not limited to, approval of a permit and plan check or design review of a project.

Local water provider: any entity, including a public agency, city, county, special district, or private water company that provides retail water service.

Low flow irrigation or drip irrigation: the application of irrigation water at low pressure through a system of tubing or lateral lines and emitters such as point source emitters, dripper lines, microsprays and bubblers. Low flow irrigation systems apply small volumes of water slowly at or near the root zone of plants.

Main line: the pressurized pipeline that delivers water from the water source to the valve or outlet.

Master shut-off valve: an automatic valve installed at the irrigation supply point which controls water flow into the irrigation system. When this valve is closed water will not be supplied to the irrigation system.

Maximum Applied Water Budget: the upper limit of annual applied water (supplemental irrigation water) for the established landscaped area as specified in Appendix A. It is based upon the area's reference evapotranspiration and is adjusted for plant factors and irrigation efficiency, two major influences upon the amount of water that needs to be applied to the landscape.

Microclimate: the climate of a small, specific area that may contrast with the climate of the overall landscape area due to factors such as wind, sun exposure, plant density, or proximity to reflective surfaces.

Mulch: any organic material such as leaves, bark, straw, compost or inorganic mineral materials such as rocks, gravel, or decomposed granite left loose and applied to the soil surface for the beneficial purposes of reducing evaporation, suppressing weeds, moderating soil temperature, and preventing soil erosion.

New construction: for the purposes of this ordinance, a new building with a landscape or other new landscape, such as a park, playground, or greenbelt.

Non-residential landscape: landscapes in commercial, institutional, industrial and public settings that may have areas designated for recreation or public assembly. It also includes portions of common areas of common interest developments with designated recreational areas.

Operating pressure: the pressure at which the parts of an irrigation system are designed by the manufacturer to operate.

Overhead sprinkler irrigation systems: systems that deliver water through the air (pop-ups, rotors, etc.)

Overspray: the water that is delivered beyond the target area.

Permeable: any surface or material that allows the passage of water through the material and into the underlying soil.

Project applicant*: the individual or entity submitting a plan to request a permit, plan check, or design review from the local agency. A project applicant may be the property owner or designee including the contractor.

Rain sensor or rain sensing shutoff device: a component which automatically suspends an irrigation event when it rains.

Reclaimed water, recycled water, or treated sewage effluent water: treated or recycled waste water of a quality suitable for non-potable uses such as landscape irrigation and water features. This water is not intended for human consumption.

Record drawing: a set of reproducible drawings which show changes in the work made during construction and which are usually based on drawings marked up in the field and other data furnished by the contractor.

Recreational area: areas of active play or recreation such as sports fields, school yards, picnic grounds, or other areas with intense foot traffic.

Reference evapotranspiration or ET: a standard measurement of environmental parameters which affect the water use of plants. ET is typically expressed as the depth of water in inches or the volume of water in gallons used by an irrigated landscape area over a period of time, as represented in Appendix A, and is based on an estimate of the evapotranspiration of a large field of four- to seven-inch tall, cool-season grass that is well watered. Reference evapotranspiration (ET_o) is used as the basis of determining the Maximum Applied Water Budget. One inch is approximately 0.623 gallons per square foot.

Renovated landscape*: any re-landscaping project that requires a permit, plan check, or design review and the modified landscape area is equal to or greater than _____ (square feet).

Remote control valve: a device used to control the flow of water in the irrigation system.

Residential landscape: landscapes surrounding single or multifamily homes such as duplexes.

Runoff: water which is not absorbed by the soil or landscape to which it is applied and flows from the area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate), run times are set too long or a valve is stuck open, when there is a severe slope, etc.

Smart irrigation controller: an automatic timing device with nonvolatile memory used to remotely control valves that operate an irrigation system. Smart irrigation controllers are able to self-adjust and schedule irrigation events using either evapotranspiration (weather-based), soil moisture data or flow data or a combination of methods.

Soil moisture sensing device or soil moisture sensor: a device that measures the amount of water in the soil. The device may also suspend or initiate an irrigation event.
Sprinkler head: a device that sprays water through a nozzle.

Static water pressure: the pipeline or municipal water supply pressure when water is not flowing.

Station: typically an area served by one valve; for very large properties, a station could control two or more valves in a given “zone”.

Sub meter: a metering device to measure water applied to the landscape that is installed after the primary utility water meter.

Turf or turfgrass: a surface layer of earth containing mowed grass with its roots. Annual bluegrass, Kentucky bluegrass, Perennial ryegrass, fescue, and Tall fescue are cool-season grasses. Bermudagrass, Blue Grama, and Buffalo grass are warm-season grasses.

Valve: a device used to control the flow of water in the irrigation system.

Watering window: the period in which irrigation is allowed (e.g. time of day, days of the week, amount over a period of a week, etc.).

Zone: typically, an area served by a single control valve, sometimes referred to as a “station”. Zones are comprised of plant materials and soil types with similar water requirements.

5. DOCUMENTATION

5.1 Landscape and Irrigation Documentation Package

The Landscape and Irrigation Documentation Package shall include the following six (6) elements:

5.1.1 Checklist of all documents in Landscape and Irrigation Documentation Package

5.1.2 Project information

a. Date

b. Project contacts for the project applicant, landscape and irrigation system installer, and property owner

c. Project address (if available, parcel and/or lot number(s))

d. Total landscaped and irrigated areas (square feet)

e. Project type (e.g., new, rehabilitated, public, private, homeowner-installed)

f. Water supply type (e.g., potable, recycled, well) and identify the local retail water provider if the applicant is not served by a private well.

5.1.3 Applicant signature and date with statement, "I agree to comply with the requirements of the water efficient landscape ordinance and submit a complete Landscape and Irrigation Documentation Package".

5.1.4 Water Efficient Landscape Worksheet

5.1.5 Landscape Design Plan with Soil Information

a. All applicable soil criteria and standards shall be noted on the landscape design plan.

b. A soil analysis report and associated information shall be provided if the project applicant chooses to appeal the standard soil amendment criteria.

5.1.6 Irrigation Design Plan

5.2 Compliance with the Landscape and Irrigation Documentation Package*

5.2.1 Prior to construction, the local agency shall:

a. Provide the project applicant with the ordinance and procedures for permits, plan checks, or design reviews.

b. Review the Landscape and Irrigation Documentation Package submitted by the project applicant.

c. Approve or deny the Landscape and Irrigation Documentation Package.

d. Issue a permit or approve the plan check or design review for the project applicant.

e. Upon approval of the Landscape and Irrigation Documentation Package, submit a copy of the Water Efficient Landscape Worksheet to the local water provider (if the water provider is separate from the local land use agency).

5.2.2 Prior to construction, the project applicant shall:

a. Submit a Landscape and Irrigation Documentation Package to the local agency.

b. Receive the authorization to proceed.

5.2.3 Upon approval of the Landscape and Irrigation Documentation Package by the local agency, the project applicant shall:

a. Receive a permit or approval of the plan check or design review and record the date of the permit in the Certificate of Completion.

b. Submit a copy of the approved Landscape and Irrigation Documentation Package along with the record drawings, and any other information to the property owner or his/her designee.

c. Submit a copy of the Water Efficient Landscape Worksheet to the local water provider (if separate from the local agency).

6. LANDSCAPE CRITERIA

Unless otherwise specified within a particular land use, the criteria within this section shall apply to all land uses. The local agency* reserves the right to conduct inspections as deemed necessary at the expense of the project applicant if there is indication that the criteria have not been followed.

6.1 Soil Criteria

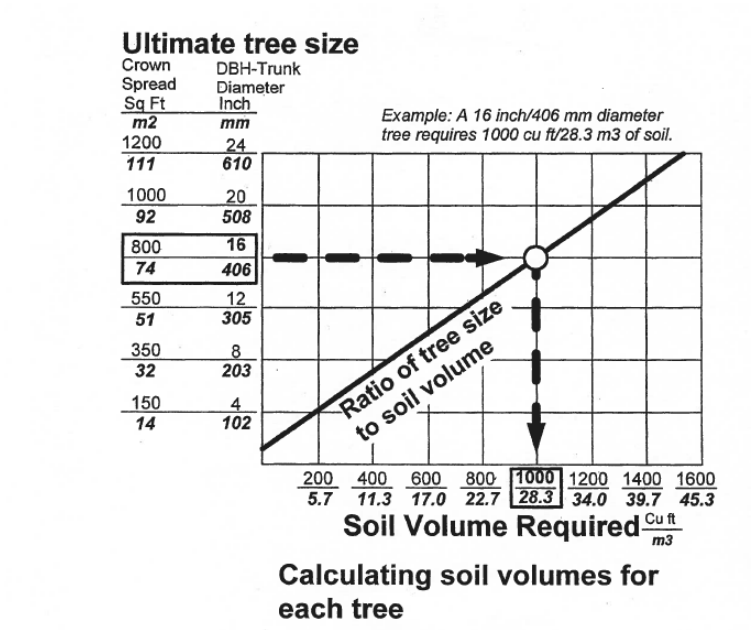
6.1.1 Soil Amendment

a. A minimum of four (4) cubic yards of organic matter soil amendment per one-thousand square feet of landscaped area shall be required for grasses (including turf), shrubs, perennials, and annuals. Minimum amendment for trees shall be consistent with the needs of the tree and the site. See Figure 1 regarding soil volumes for trees.

b. Soil amendment organic matter shall consist of either Class I or Class II compost.

c. Source water, such as non-potable water should be considered.

Figure 1: Tree Soil Volume



d. Soil Evaluation and Improvement

The following soil evaluation procedure may be utilized if the project applicant chooses to apply for an exemption from the standard soil amendment criteria and/or if the local water provider requires verification of the soil amendment. The soil evaluation determines the condition of the soil related to texture, acidity, salts, and plant nutrient availability.

i. The applicant must discuss the appeal informally with the local agency* to determine the procedures and submittal requirements.

ii. The applicant shall submit an explanation in narrative form explaining the appeal and attach any information including site-specific data and the following soil analyses:

(a) A soil analysis shall be conducted by a professional soil scientist at a certified soils laboratory.

(b) Soil sample(s) shall be taken after over lot grading, if applicable, and prior to landscaping.

(c) The soil sample must represent a uniform area. Differences in texture (sand, silt, clay), color, slope, degree of erosion, drainage, past management practices, types of plant materials designed for each area should be taken into account when collecting the sample. The soil scientist shall determine the sample sites, depth and frequency necessary to reflect a representative sample of the site and to coincide with the plant material intended for the area in the design. Recommended sampling frequency is no less than one (1) sample per five-thousand (5,000) square feet. Any sampling less than this frequency shall be justified by the soil scientist.

(d) The soil analysis shall determine the organic and inorganic composition of native/indigenous soil in landscaped areas, and shall include:

- Soil texture
- Total exchange capacity
- Conductivity
- Organic matter
- Acidity
- Content of nitrogen (NO3, Phosphorus, Potassium, Zinc, Iron, Copper, Manganese and Lime)

iii. The soil analysis shall include specific recommendations based on the soil test results for the type of plant material to be grown in each landscaped area. The type and volume of soil amendment shall be determined by the soil scientist and be consistent with the indigenous soil and the needs of the plant materials in each area of the landscape.

e. Upon receipt of the information, _____ shall approve or deny the soil amendment. If the amendment is denied, _____ shall provide information to the project applicant regarding additional requirements.

6.1.2 Soil Preparation

a. Amendment shall be tilled to a minimum depth of six inches (6”).

b. Site shall be graded to within two-tenths of a foot (2/10th’) of the grading plan.

c. Site shall be free of rocks, dirt clods, and debris over three-quarter inch (3/4”) diameter in size.

d. Dryland seed areas may contain dirt clods up to two inch (2”) diameter in size.

i. Stockpiling - Stripping and stockpiling of indigenous soil (topsoil) shall be required during construction (except as waived by the local agency*). The replacement of this soil, plus additional soil amendments, are critical to successful plant material establishment, ongoing health, and efficient use of water through the life of the project.

ii. Structural Soil - Cornell University (CU) structural soil[2] is recommended for all approved narrow street tree planting strips less than eight (8) foot in width (measured back of curb to edge of walk), or otherwise approved narrow areas, as well as in tree grates (within public right of way). See Appendix C for standard Details for structural soil requirements.

iii. All applicable soil criteria and standards shall be noted on the landscape design plan. Written verification of approved soil amendment type and volume is required. Installation of amendment and soil preparation shall be inspected by the local agency*. Projects with inadequate soil amendment and preparation will not be approved.

6.1.3 Soil Inspection

a. Soil inspections are required prior to installation of plant material, and shall include a review of adherence to all criteria and performance standards.

b. Written documentation reflecting approved volume and type of soil amendment is required upon inspection.

6.2 Non-Living General Landscape Design Criteria

6.2.1 Organic mulch.

a. Shall be applied at one (1) cubic yard per eight (80) square feet at a depth of four (4) inches, and as appropriate to each species.

b. Shall be applied to the soil surface, not against the plant stem, or high against the base of trunks to minimize disease.

c. Organic mulch material includes bark and wood chips. Avoid construction debris such as pallets.

6.2.2 Inorganic mulch includes rock, gravel, or pebbles (pea gravel).

a. Rock mulch shall have a minimum depth of two inches (2”).

b. Recycled rubber for landscape use is discouraged, however may be considered for playground use.

6.3 General Landscape Design Criteria

6.3.1 Plant Material

a. Any plant from the Recommended Plant List may be selected for the landscape, providing the Average Plant Water Need for all zones does not exceed the Maximum

[2] See: http://www.hort.cornell.edu/uhi/outreach/pdfs/CU-Structural%20Soil%20-%20A%20Comprehensive%20Guide.pdf

Applied Water Budget of 19 gallons/square-foot of irrigated landscape area (approximately 11.8 inches). An estimate of the plant water need, in gallons per square foot per season, must be provided for any plants that are not currently included in the recommended plant list. See Appendix A for details regarding the Maximum Applied Water Budget calculation and Appendix B for the Recommended Plant List.

b. Each hydro-zone shall have plant materials with similar water use.

c. Plants shall be selected and planted appropriately based upon their adaptability to the climatic, geologic, and topographical conditions of the project site. To encourage the efficient use of water, the following are highly recommended:

   i. Selection of plants from Recommended Plant List included in Appendix B and particularly water-conserving plant and turf species.

   ii. Protection and preservation of native species and natural vegetation.

   iii. Selection of plants based on disease and pest resistance.

   iv. The use of invasive and/or noxious plant species is prohibited.

   v. Selection of trees based on applicable local tree ordinances or tree shading guidelines.

   vi. Recognize the horticultural attributes of plants (i.e., mature plant size, invasive surface roots) to minimize damage to property or infrastructure [e.g., buildings, sidewalks, power lines].

   vii. Consider the solar orientation for plant placement to maximize summer shade and winter solar gain.

d. Turf is not allowed on slopes greater than 25% where the toe of the slope is adjacent to an impermeable hardscape and where 25% means 1 foot of vertical elevation change for every 4 feet of horizontal length (rise divided by run x 100 = slope percent).

e. The architectural guidelines of a common interest development, which include community apartment projects, condominiums, planned developments, shall not prohibit or include conditions that have the effect of prohibiting the use of low-water use plants as a group.

6.3.2 Water Features

a. Recirculating water systems shall be used for water features.

b. Where available, recycled water is recommended as a source for decorative water features.

c. The surface area of a water feature shall be included in the high water use hydrozone area of the water budget calculation.

d. Pool and spa covers are highly recommended.

6.3.3 Stormwater Management

a. Stormwater management practices minimize runoff and increase infiltration which recharges groundwater and improves water quality. Implementing stormwater best management practices into the landscape and grading design plans to minimize runoff and to increase on-site retention and infiltration are encouraged.

b. Project applicants shall refer to the local agency* for information on any applicable stormwater ordinances and stormwater management plans.

c. Rain gardens, cisterns, and other landscapes features and practices that increase rainwater capture and create opportunities for infiltration are recommended, to the extent permissible by law[3].

6.4 Landscape Design Plan

The landscape design plan, at a minimum, shall:

6.4.1 Delineate and label each hydrozone by number, letter, or other method.

6.4.2 Identify each hydrozone as low, moderate, high water, or mixed water use. Temporarily irrigated areas of the landscape shall be included in the low water use hydrozone for the water budget calculation.

6.4.3 Identify recreational areas.

6.4.4 Identify areas permanently and solely dedicated to edible plants.

6.4.5 Identify areas irrigated with recycled water.

6.4.6 Identify type of mulch and application depth.

6.4.7 Identify soil amendments, type, and quantity.

6.4.8 Identify type and surface area of water features.

[3] See http://water.state.co.us/SURFACEWATER/RAINWATERCOLLECTION/Pages/default.aspx

6.4.9 Identify hardscapes (pervious and impervious).

6.4.10 Identify location and installation details of any applicable stormwater best management practices that encourage infiltration of stormwater. Stormwater best management practices are encouraged in the landscape design plan and examples include, but are not limited to:

a. Infiltration beds, swales, and basins that allow water to collect and soak into the ground.

b. Constructed wetlands and retention ponds that retain water, handle excess flow, and filter pollutants.

c. Pervious or porous surfaces (e.g., permeable pavers or blocks, pervious or porous concrete, etc.) that minimize runoff.

6.4.11 Identify any applicable rain harvesting or catchment technologies (e.g., rain gardens, cisterns, etc.).

6.4.12 Contain the following statement: "I have complied with the criteria of the ordinance and applied them for the efficient use of water in the landscape design plan".

6.4.13 The signature of a licensed landscape architect, licensed/certified landscape contractor, or any other person authorized to design a landscape.

7. IRRIGATION SYSTEM CRITERIA

This section applies to landscaped areas requiring permanent irrigation. For the efficient use of water, an irrigation system shall be planned and designed according to the most current version of the *Landscape Irrigation Best Management Practices*, by the Irrigation Association and the American Society of Irrigation Consultants.

7.1 Irrigation System Requirements

7.1.1 Backflow prevention devices shall be required to protect the potable water supply from contamination by the irrigation system and comply with local plumbing codes.

7.1.2 Manual shut-off valves (such as a gate valve, ball valve, or butterfly valve) shall be required, as close as possible to the point of connection of the water supply and to isolate sections of mainline on larger systems, to minimize water loss in case of an emergency (such as a main line break) or routine repair.

7.1.3 Master shut-off valves and flow sensors, integrated with the automatic irrigation controller are recommended for all landscapes, and required for all non-residential landscapes.

7.1.4 Dedicated landscape water meters shall be installed for all non-residential irrigated landscapes.

7.1.5 Smart irrigation controllers labeled by U.S. Environmental Protection Agency's WaterSense Program or with published reports posted on the Smart Water Application Technologies website

are recommended for residential projects and required for all non-residential projects. If a flow meter is used, then the controller shall be able to use inputs from the flow meter/sensor to control irrigation if flows are abnormal.

7.1.6 Sensors (rain, freeze, wind, soil moisture etc.), either integral or auxiliary, that suspend or alter irrigation operation during unfavorable weather conditions or when sufficient soil moisture is present shall be required on all irrigation systems, as appropriate for local climatic conditions.

7.1.7 Shall be designed to prevent runoff, low head drainage, overspray, or other similar conditions where irrigation water flows onto non-targeted areas, such as adjacent property, non-irrigated areas, hardscapes, roadways, or structures. In order to reduce runoff, and maximize sprinkler effectiveness, maximum application rate shall be 1.25 inches per hour. Restrictions regarding overspray and runoff may be modified if the landscape area is adjacent to permeable surfacing and no runoff occurs or if the adjacent non-permeable surfaces are designed and constructed to drain entirely to landscaping.

7.1.8 Six inch (6") minimum pop up height in turf areas is required for all spray heads and rotors.

7.1.9 Check valves or anti-drain valves are required on all sprinkler heads.

7.1.10 The irrigation systems shall be designed to ensure that the operating pressure at each emission device is within the manufacturer's recommended pressure range for optimal performance.

a. To control excessive pressure above the required operating pressure of the irrigation system emission devices, pressure-regulating devices such as valve pressure regulators, sprinkler head pressure regulators, inline pressure regulators, or other devices shall be installed to meet the required operating pressure of the emission devices.

b. If water pressure is below the required operating pressure of the emission devices, then a booster pump shall be installed so that emission devices shall operate at the manufacturer's recommended pressure.

c. The pressure and flow measurements shall be identified at the design stage and verified prior to the installation of the system.

7.1.11 All irrigation emission devices shall meet the requirements set in the American National Standards Institute (ANSI) standard, ASABE/ICC 802-2014 "Landscape Irrigation Sprinkler and Emitter Standard" authored by the American Society of Agricultural and Biological Engineers and the International Code Council and verified by an independent third-party.

7.1.12 The design of the irrigation system shall conform to the hydrozones of the landscape design plan.

7.1.13 Sprinklers within a zone shall have matched precipitation rates, unless otherwise directed by the manufacturer's recommendations. Maximum 1.25 inches per hour application rate.

7.1.14 Sprinkler spacing shall be designed to achieve the highest possible distribution uniformity using the manufacturer's recommendations. Spacing must achieve head-to-head coverage. Minimum acceptable distribution uniformities shall be sixty (60) percent for spray head zones and seventy (70) percent for rotor zones. Sprinkler heads equipped with multi-stream rotary nozzles are considered rotors.

7.1.15 The irrigation system must be designed and installed to meet, at a minimum, any water windows or restrictions for operation such as day of the week and hours of the day.

7.2 Hydrozone Requirements

7.2.1 Each remote control valve shall irrigate a hydrozone with similar microclimate, soil conditions, slope, and plant materials with similar water demand.

7.2.2 Relevant soils information such as soil type and infiltration rate shall be utilized when designing irrigation systems.

7.2.3 Narrow or irregularly shaped areas, including turfgrass areas, less than ten feet (10 ft) in dimension in any direction shall not utilize overhead sprinkler irrigation.

7.2.4 Slopes greater than 25% shall not use sprinklers with an application rate exceeding 0.75 inches per hour. Prevention of runoff and erosion shall be confirmed during the irrigation audit.

7.2.5 Sprinkler heads and other emission devices shall be selected based on what is appropriate for the plants and soil type within that hydrozone. Individual hydrozones that mix high and low water use plants shall not be permitted.

7.2.6 In mulched planting areas, the use of low flow irrigation is required for any vegetation that will exceed 12 inches mature height.

7.2.7 Where feasible, trees shall be placed on separate valves from shrubs, groundcovers, and turfgrass to facilitate the appropriate irrigation of trees. The mature size and extent of the root zone shall be considered when designing irrigation for the tree.

7.2.8 Hydrozone areas shall be designated by number, letter, or other designation on the landscape design plan and irrigation design plan. On the irrigation design plan, designate the areas irrigated by each valve, and assign a number to each valve. Use this valve number in the Hydrozone Information Table (see Appendix A). This table can also assist with the irrigation audit and controller programming.

7.3 Irrigation Design Plan

An irrigation design plan meeting the following design criteria shall be submitted for review and approval by the jurisdiction* having authority and a permit issued if required.

7.3.1 Plan Requirements

The irrigation design plan, at a minimum, shall contain:

a. A scaled plan showing property lines, easements, existing or proposed structures, impervious surfaces, and existing natural features;

b. Location and size of the point of connection to the water supply and meter locations along with static water pressure at the point of connection to the water supply and dynamic water pressure for proper system operation;

c. Reclaimed/recycled water or alternative water sources such as graywater shall comply with local plumbing codes including marking of pipes and system components;

d. Location, type and size of all components of the irrigation system, including, backflow preventer, flow sensor, master valve, smart irrigation controllers, main and lateral lines, manual valves, remote control valves, sprinkler heads, moisture sensing devices, rain switches, on-site weather monitoring sensors, quick couplers, pressure regulators;

e. An irrigation legend showing the identification of irrigation components;

f. Flow rate (gallons per minute), application rate (inches per hour), and design operating pressure (pressure per square inch) for each irrigation zone;

g. Installation details for each of the irrigation components.

h. Designer statements and signature:

   i. The following statement: “I have complied with the criteria of the ordinance and applied them accordingly for the efficient use of water in the irrigation design plan”; and

   ii. The signature of a qualified irrigation professional such as licensed landscape architect with irrigation credentials, certified irrigation designer, licensed/certified landscape contractor, or any other person authorized to design an irrigation system within the jurisdiction.

7.4 Landscape Irrigation Audit

7.4.1 All landscape irrigation audits shall be conducted by a third party certified landscape irrigation auditor. Irrigation audits shall not be conducted by the person or company who installed the irrigation system.

7.4.2 The project applicant shall submit an irrigation audit report with the Certificate of Completion to the local agency*. The irrigation audit report may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or runoff that causes overland flow, and preparation of an irrigation schedule, including configuring irrigation controllers with application rate, soil types, plant factors, slope, exposure and any other factors necessary for accurate programming.

7.5 Certificate of Completion*

7.5.1 Proper installation and management of the irrigation system shall conform to the approved irrigation design plan.

7.5.2 The Certificate of Completion shall include the following six (6) elements:

a. Project information sheet that contains:

   i. Date;

   ii. Project name;

   iii. Project address and location;

   iv. Project applicant name, telephone, and mailing address; and

   v. Property owner name, telephone, and mailing address;

b. Certification by the irrigation designer and the licensed landscape/irrigation contractor that the irrigation system has been installed per the approved irrigation design plan.

c. Record drawings (as-builts), provided in electronic format, showing all changes from the approved plan shall be included with the certification.

d. A diagram of the irrigation design plan showing hydrozones and the irrigation scheduling parameters used to set the controller shall be kept with the irrigation controller for subsequent management purposes.

e. Landscape and irrigation maintenance schedule.

f. Irrigation audit report.

7.5.3 The project applicant shall:

a. Submit the signed Certificate of Completion to the local agency for review.

b. Ensure that copies of the approved Certificate of Completion are submitted to the local water provider (if separate from the local agency) and property owner or his or her designee.

7.5.4 The local agency shall:

a. Receive the signed Certificate of Completion from the project applicant.

b. Approve or deny the Certificate of Completion. If the Certificate of Completion is denied, the local agency shall provide information to the project applicant regarding reapplication, appeal, or other assistance.

7.6 Irrigation System Maintenance Schedule

7.6.1 Irrigation systems shall be maintained to ensure proper operation and function for water use efficiency. A regular maintenance schedule shall be submitted with the Certificate of Completion.

7.6.2 A regular maintenance schedule shall include, but not be limited to, routine inspection, auditing, adjustment and repair of the irrigation system and its components. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.

7.6.3 Repair of all irrigation equipment shall be done with the originally installed components. If equipment components with greater efficiency are used in replacement, the entire zone must be changed to maintain consistency.

7.7 Irrigation Scheduling

For the efficient use of water, all irrigation schedules shall be developed, managed, and evaluated to utilize the minimum amount of water required to maintain plant health. Irrigation schedules shall meet the following criteria:

7.7.1 Irrigation scheduling shall be regulated by smart irrigation controllers that utilize evapotranspiration data or soil moisture data.

7.7.2 Overhead irrigation shall be scheduled between 8:00 p.m. and 8:00 a.m. unless weather conditions prevent it. If allowable hours of irrigation differ from the local water provider, the stricter of the two shall apply. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.

7.7.3 Parameters used to set the automatic controller shall be developed and submitted for each of the following:

a. The plant establishment period.

b. The established landscape.

c. Temporarily irrigated areas.

7.7.4 Each irrigation schedule shall consider for each station all of the following that apply (if not determined by the smart controller):

a. Irrigation interval (days between irrigation).

b. Irrigation run times (hours or minutes per irrigation event to avoid runoff).

c. Number of cycle starts required for each irrigation event to avoid runoff.

d. Amount of applied water scheduled to be applied on a weekly basis.

e. Application rate setting.

f. Root depth setting.

g. Plant type setting.

h. Soil type.

i. Slope factor setting.

j. Shade factor setting.

k. Irrigation uniformity or efficiency setting, based on audit information.

APPENDIX A – WATER EFFICIENT LANDSCAPE WORKSHEET

Note to local entities: Irrigation water needs can be estimated from a standard cool-season grass reference crop ET and information on the specific landscape plantings and irrigation methods. The Green Industries of Colorado (GreenCO) provides a local plant list that identifies water needs (High, Moderate, Low, Very Low) as a percentage of the reference ET for Kentucky bluegrass (ET_o), a standard cool-season turfgrass reference crop[4]. The following information is provided as an example and should be update by the local entity.

This worksheet is completed by the project applicant and is a required element of the Landscape and Irrigation Documentation Package.

SECTION A. GALLONS OF WATER NEEDED BY PLANT CATEGORY AND IRRIGATION TYPE

The specific water needs of each hydrozone in the design should be determined using the following factors (Irrigation Water Need = ET_o × Plant Factor × Irrigated Area ÷ Irrigation Efficiency × 0.623).

Water Use Category	Plant Factor
Cool-Season Turf	0.90
High	0.80
Medium	0.65
Low	0.40
Very Low	0.10

Irrigation Method	Default Efficiency
Overhead Spray	75%
Drip	90%

SECTION B. HYDROZONE INFORMATION TABLE AND WATER BUDGET CALCULATION

Complete the hydrozone table for each hydrozone. Use as many rows as necessary to provide the square footage of landscape area per hydrozone.

The following is provided as an example only, using a typical reference ET_o for the metro Denver area of 35 inches/season or approximately 21.8 gallons/square foot.

Hydrozone	Plant Water Use Category	Plant Factor	Irrigation Method	Irrigation Efficiency	Hydrozone Area (Sq. Ft.)	Irrig Water Need (gal/season)
Zone 1	L	0.40	Drip	0.90	1500	14537
Zone 2	M	0.65	Overhead	0.75	750	14173
Zone 3	Cool-Season Turf	0.90	Overhead	0.75	2500	65415
Zone 4	VL	0.10	Drip	0.90	250	606
				TOTAL	**5000**	**94731**

AVERAGE IRRIGATION WATER NEED ALL ZONES*: _____18.9_____ gal/sf/season

The average must be less than the Maximum Applied Water Budget of 19 gal/sf/season.

[4] See: http://www.greenco.org/images/downloadables/BMP_Manual_Appendices.pdf

APPENDIX B – RECOMMENDED PLANT LIST

Local entity to insert local recommended plant list here.

For example only, see: http://www.crgov.com/documentcenter/view/7016

APPENDIX C – STRUCTURAL SOIL REQUIREMENTS

Cornell University (CU) Structural Soil is a designed medium which can meet or exceed pavement design and installation requirements while remaining root penetrable and supportive for tree growth. It consists of gap-graded gravels which are made up of crushed stone, clay loam, and a hydrogel stabilizing agent. The materials can be compacted to meet all relevant pavement design requirements yet allow for sustainable root growth. This system essentially forms a rigid, load-bearing stone lattice and partially fills the lattice voids with soil. Structural soil provides a continuous base course under pavements while providing material for tree root growth, shifting design away from individual tree pits, to a designed, root penetrable, high strength, pavement system. An added advantage of using this material is its ability to allow roots to grow away from the wearing surface, thus reducing the potential for sidewalk heaving as well as providing for healthier, long-lived trees.

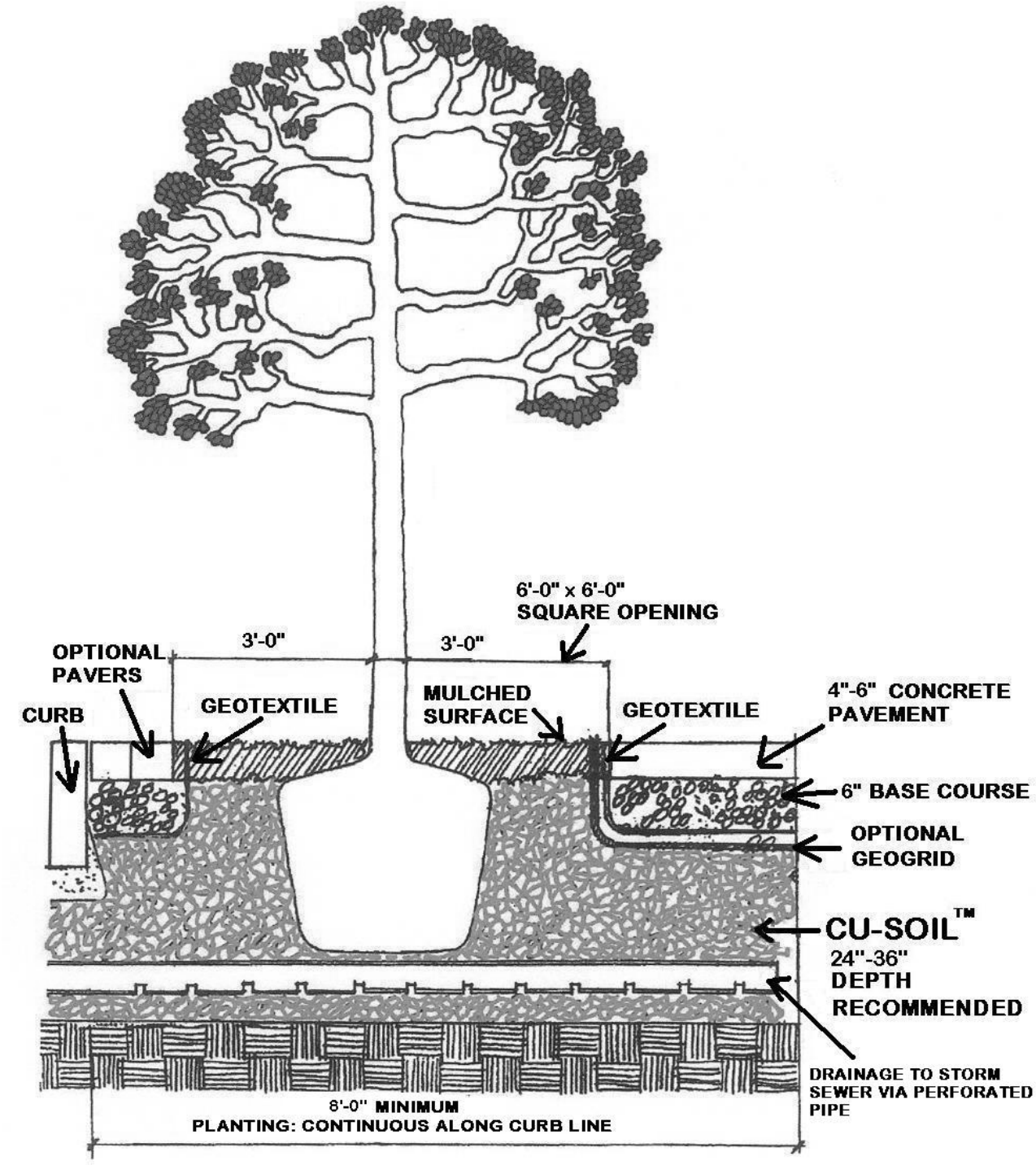
This system consists of a four to six-inch rigid pavement surface, with a pavement opening large enough to accommodate a 40 year or older tree. The opening could be concentric rings of pavers designed for removal as the buttress roots lift them. Below that a six-inch base course could be installed and compacted with the material meeting normal regional pavement specifications for the traffic they are expected to experience. The base acts as a root exclusion zone from the pavements surface. A geotextile (weed barrier) segregates the base course from the subbase and extends as an apron emerging around the edges of the concrete. A gap-graded, structural soil material demonstrated to allow root penetration when compacted would be the subbase and area for subsequent tree root growth. This material would be compacted to not less than 95% Proctor density (AASHTO T-99) and possess a California Bearing Ratio greater than 40. The subbase thickness would depend on the depth of sub grade or to a proposed target of 36 inches. This is negotiable, but a 24 inch minimum would be encouraged for the root zone. The sub grade should be excavated to parallel the final grade. Under-drainage must be provided under the structural soil material conforming to approved engineering standard for that region.

The three components of the Structural Soil are mixed in the following proportions by weight:

Crushed Stone (granite or limestone, graded from ¾ to 1 ½", highly angular, with no fines) – 100
Clay Loam – 20
Hydrogel – 0.03

In a typical street tree installation of such a structural soil, the potential rooting zone could extend from the building face to curb, running the entire length of the street. This would ensure an adequate volume of soil to meet the long term needs of the tree. Where this entire excavation is not feasible, a trench, running parallel to the curb, eight feet wide and three feet deep would be minimally adequate. Since this profile has adapted the standard surface and base specifications generally in use, less hesitation for engineering approval may result.

There will be a need to ensure moisture recharge and free gas exchange throughout the root zone which is not the entire subbase. The challenge is met by the installation of a three dimensional geo-composite (a geo-grid wrapped in textile one-inch thick by eight inches wide) which could be laid above the subbase as spokes radiating from the trunk flair opening. This form of passive irrigation is currently in the testing stage. Other previous surface treatments could also provide additional moisture recharge, as could traditional irrigation.


6'-0" x 6'-0"
SQUARE OPENING
3'-0"
3'-0"
OPTIONAL
PAVERS
CURB
GEOTEXTILE
MULCHED
SURFACE
GEOTEXTILE
4"-6" CONCRETE
PAVEMENT
6" BASE COURSE
OPTIONAL
GEOGRID
CU-SOIL™
24"-36"
DEPTH
RECOMMENDED
DRAINAGE TO STORM
SEWER VIA PERFORATED
PIPE
8'-0" MINIMUM
PLANTING: CONTINUOUS ALONG CURB LINE