Jacksonville Tree Commission

TASK FORCE ON URBAN TREE PLANTING BEST PRACTICES
January 27, 2025 10:00am - 1:00pm
Ed Ball Building, 10th Floor, Conference Room 5
and Zoom Webinar

All agenda materials will be available at *https://www.jacksonville.gov/departments/public-works/tree-commission* by Wednesday, January 22, 2025 under the meeting link (Task Force Urban Tree Planting Best Practices Meeting Notice* January 27, 2025 10:00am - 1:00pm)

Task Force Members:

Susan Fraser, Tree Commission Member, Chair
Nina Sickler Tree Commission Member, Vice-Chair
Curtis Hart, Tree Commission Member
William Burke, Tree Commission Member

Non-Member attendees:

Jeff Lucovsky, PDDS
Jonathan Johnston, Parks
Guy Parola, DIA
Nancy Powell, Scenic Jax
Lisa Grubba, Greenscape
Valerie Feinberg, Fuse Fellow, UFMP

Advisors:

Jonathan Colburn, Urban Forestry Manager
Justin Gearhart, City Arborist
Shannon MacGillis, Office of General Council

Staff:

Joe Rainey, Executive Assistant

AGENDA

Order of Agenda is Subject to Change

1. **Call to Order –** Chair

2. **Roll Call and Verification of Quorum** – Chair Submittal of Speaker's cards

3. **Public Comment: (up to 3 minutes, allotted at discretion of Chair)**

4. **Submittal of Speaker's Cards –** Chair
   - **a.** A raised hand icon will be acknowledged by the Chair.
   - **b.** For those attending in person, paper speakers' cards will be available.

5. **Approval of Minutes of November 8, 2024 Task Force Meeting**
    a. Policy Position Discussion
        i. Plant for longevity and ultimate size
        ii. Natural Solutions First, Constraints' Mitigation Second

6. **Existing Standards Review Presentations** (materials/summaries under meeting link)
    a. FDOT 2025 Design Manual Standards/ Details - Susan Fraser
    b. SSPAC's proposed revisions to the Land Development Procedures Manual - Bill Burke
    c. COJ Public Works planting standards - Jonathan Colburn
    d. DIA planting standards - Susan Fraser
    e. Approved Tree Planting List Notes - Justin Gearhart

ACTION ITEMS:

7. **Resource Library Available**
    a. All materials collected to inform the Committee will be found here: https://www.jacksonville.gov/departments/public-works/tree-commission/task-force-library
    b. Submittal of materials to resource library will be ongoing

8. **Development of Constrained Planting Environment Standards framework:**
    a. James Urban's 1992 article entitled "Bringing Order to the Technical Dysfunction within the Urban Forest", Journal of Arboriculture Volume 18, issue 2, March 1992
    b. Application of Approach and Matrix to Jacksonville

NEW BUSINESS:

9. **Discussion of Vertical Constraints –** Jonathan Colburn

10. **Approved Tree Planting List:**
    a. Benefit Expectations
    b. Potential Species Characteristics to be Identified:
        i. Planting Zone
        ii. Mature Height and Spread
        iii. Root Characteristics (invasive?)
        iv. Suitability as a street tree adjacent to pedestrians
        v. Suitability as street tree without pedestrian adjacency
        vi. Maintenance Score
        vii. Wind Resistance
        viii. Water requirements Optimum
        ix. soil volume (min / optimum)
        x. Lifespan
        xi. Crown shape

13. Meeting Dates for January - May 2025

Feb 20th 10am -2pm

March 19th 10am -2pm

April 17th 10am -2pm

May 14th 10am -2pm

OLD BUSINESS:

14. Tree Commission Approval of Revised Charge Memo

a. Amended definition of "Urban' in Charge Memo
b. Extension of Task Force to May 31, 2025

15. The Good, the Bad and the Ugly – Photo Gallery

16. ADJOURNMENT

Task Force on Urban Tree Planting Best Practices

Minutes
Friday November 8, 2024, – 1:30pm
Via Zoom Platform & In Person
[Recording of Meeting can be obtained by sending request to Charles Hayes kennethh@coj.net]

Commissioners:
Nina Sickler, Director of Public Works
Susan Fraser, Chair (Council Appointee; 2022-0063-A)
William Burke (Mayor Appointee; 2023-0695-A)

Advisors:
Jonathan Colburn - Urban Forestry Manager
Justin Gearhart - City Arborist
Shannon MacGillis - Office of General Counsel

Staff: Joe Rainey

1. Call to Order
Conducted by Chair

2. Roll Call and Verification of Quorum
Conducted by Chair
Commissioners present:
Susan Fraser - Chair
Nina Sickler
William Burke

Quorum present (4, in person): yes

3. Call for Public Speakers (online & card):

a) **John Nooney – (Public Speaker) –** Stated that public access to water ways is disastrous. Stated November 14, his property may be acquired.

Action Items:

1. Identify Task Force Scope of Work

Issue: Task Force Scope based on Charge Memo

Discussion: Fraser: Gave an overview of what the goal is for Task Force.

1. Task 1 – **Fraser:** Discussed looking for standards for planting and goal is "what is your urban environment." Explain what applicants would need to meet when requesting funds from the Tree Commission. Determining qualifications of location and tree materials in relation to site
   Determined definition of Urban related to this tree committee: "As used herein the term, "Urban", Refers to planting or replanting trees anywhere in the geographic City of Jacksonville that is constrained; Horizontally, vertically, or both, by, including but not limited to, development (such as Buildings, utilities, etc.), grey infrastructure, hardscape, concrete, asphalt, pavement, or brick, etc., above or Below ground"

2. Task 2 – **Fraser:** Discussed initiative and strategies for planting trees and how to attract projects based on best application of funds.
   Evaluate current number of approved trees and their installation in relation to matured size. Review proper application/limitations based on proposed/requested location for best results.
   Discuss the potential adaptation of location among other options to provide for expanded planting opportunities. Considered options for partnership, DIA was suggested, other partners are sought.

3. Task 3 – **Fraser:** Tree Library project to provide detailed and visual representations of right and wrong ways of implementing urban tree planting. suggested photos of cities where these projects have been done well be found.

4. **Fraser:** A request to assemble Standards being developed by other committees, specifically any relevant to tree commission standards and goals. Overview of upcoming tree plantings at libraries, bus stops, etc. for opportunities to partner up. Discuss location concerns related to tree installation to include line of sight, utilities, soil

amendments, etc. what departments have previous or current experience? Acquire downtown streetscape design guidelines, sidewalk utility design standards (legislative services).

END OF MEETING 3:24PM

FDOT Design Manual
January 1, 2025

274 Selective Clearing and Grubbing (portion)

274.1.3 Tree Protection Fencing
Tree protection fencing is to protect the tree in its entirety, including the root system, trunk, branches, and surrounding soils from damage, compaction, and contamination. Utilize tree protection fencing for trees “selected” to remain when:
(1) Individual or groups of trees require preservation, or
(2) Individual or groups of trees have been relocated within the project limits.

Place fencing around the root zone, or at minimum, around the dripline of trees. See FDOT ***Standard Plans***, Index 110-100 for fencing installation requirements.

274.1.4 Branch and Root Pruning
Branch pruning is the selective removal of unwanted tree branches and provides one or more of the following benefits:
- Reduces the risk of damage to people or property
- Manages tree health and direction of growth
- Provides horizontal and vertical clearances for pedestrians, cyclists, or vehicles
- Improves tree structure, restores shape, or improves aesthetics

Root pruning is the process of cutting roots prior to mechanical excavation near a tree. Root pruning is necessary to minimize damage to the tree's critical root system during construction, or in preparation for tree relocation. The roots are typically sliced at the drip line of an established tree.

274.3 Selective C&G Maintenance Report
A Selective C&G (clearing and grubbing) Maintenance Report is required when Selective C&G sheets are included in the Roadway Plans. This Selective C&G Maintenance Report details the care and maintenance of preservation and Selective C&G areas. This document describes the intent of the Selective S&G activities and arboricultural best practices. Deliver the Selective C&G Maintenance Report to the District Project Manager.

275 Tree and Palm Relocation (all)
275.1 General
This chapter provides the criteria and requirements for relocation of trees and palms. For Tree and Palm Relocation plan content, refer to ***FDM 944***.

Relocation of trees and palms requires the approval of the District Landscape Architect. Develop a root pruning and relocation plan tailored to the species being relocated. Time periods required between root pruning and relocation must be in accordance with industry standards and ***Supplemental Specification 581***.

275.2 Relocation Considerations
When deciding to relocate a tree or palm, consider the following:

(1) Protected tree or palm species (Florida Department of Agriculture Endangered Plant Species), or local jurisdictional regulations

(2) Cost effectiveness of relocation (i.e., cost and benefit of relocating existing trees versus purchasing new nursery material)

(3) Tree or palm condition (e.g., size, form, health, structure)

(4) Aesthetic, historical, cultural, community, and environmental value

(5) Functional characteristics and engineering (e.g., safety considerations)

(6) Negative public perceptions regarding removal of healthy trees

(7) Overall suitability for relocating:

(a) Desirable and disease-resistant species

(b) Survivability

(c) Required establishment period

(d) Impact to construction schedule

(e) Removal, transport, or installation issues

275.3 Relocation Site Selection

For construction projects, trees or palms must be relocated to a site that is within or near the project limits, which decreases transport costs and increases the survival rate.

For maintenance-let landscape projects, an off-site location may be considered when there is not sufficient space to relocate a tree on-site. Off-site relocations must meet the following requirements:

- Relocation site is within the district in which the contract is let
- Acceptable plan for care during establishment period
- A written agreement with the maintaining agency has been obtained

904 Landscape Opportunity Plan

904.1 General

This chapter provides the criteria and requirements for development of the Landscape Opportunity Plan. These sheets are used for coordination purposes between projects and between the various disciplines of a project. Do not place the Landscape Opportunity Plan sheets within the Contract Plans Set. Signing and sealing the Landscape Opportunity Plan is not required.

A Landscape Opportunity Plan is prepared when landscape is not part of a roadway construction project, but landscaping will be installed:

(1) Within a subsequent stand-alone landscape project.

(2) As part of a simultaneous JPA or LAP project.

(3) Within a future safety or roundabout project.

A Landscape Opportunity Plan is typically prepared during the roadway concept plan development, but when developed during the design phase, should be preliminary by the Phase II submittal, complete at Phase III, and final at Phase IV. Coordinate with other disciplines (e.g., Roadway, Utility, Drainage, Signage, ITS, R/W) when developing the Landscape Opportunity Plan.

Submit the completed Landscape Opportunity Plan to the Department Project Manager and District Landscape Architect. Place the completed Landscape Opportunity Plan in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation Module (see ***FDM 111.7***).

270.3 Soil Enhancements

Highly disturbed soils (i.e., soils located in medians, embankments, and roundabouts) are often densely compacted, rocky, unsuitable pH levels, and infertile. These soil conditions may negatively impact plant establishment by inhibiting root growth, reducing water infiltration, and inhibiting nutrient uptake.

When possible, select plant species that can thrive in the existing or disturbed soil conditions. Soil enhancements become necessary for soil conditions that inhibit plant establishment and growth. Soil enhancements are typically limited to:

- Planting beds
- Tree or palm planting pits (typically 2-times the size of the root ball)

Excavation for amendments or replacement soil cannot occur within two feet from the back of any curb or from any structure.

270.3.1 Soil Analysis

Conduct a preliminary analysis of the existing soil conditions during the analysis phase or early in the design process to determine what plants will thrive. The preliminary analysis should include pH, soil fertility, and percolation tests. The Department may require an advanced soil analysis when preliminary analysis indicates the existing soils are not suitable for plant establishment and growth.

Provide documentation to the District Landscape Architect justifying the need for soil enhancements.

270.3.2 Soil Enhancement Selection

Select the appropriate soil enhancements based on the results of the soil analysis. There are three types of soil enhancements:

(1) Soil scarification (a.k.a., soil structural improvement) includes mechanically loosening the existing soils.

(2) Soil amendment includes mixing organic soils, inorganic soils, or minerals with the existing soils.

(3) Soil replacement with Landscape Soil. Landscape Soil material requirements are included in ***Standard Specification, Section 987***. Soil replacement is used only when either of the following conditions exist:

(a) Other soil enhancement types will not improve the quality of the existing soil to support establishment and vigorous growth of new or relocated plants.

(b) The District Design Engineer approves the use of Landscape Soil on a design project that has raised curbed medians, bulb-outs, sidewalk tree pits, and roundabout central islands to accommodate a subsequent landscape project.

273 Landscape Maintenance Guide

273.1 General

This chapter provides the criteria and requirements for the Landscape Maintenance Guide. See ***FDM 944.7*** for development of the Landscape Maintenance Guide sheet.

A Landscape Maintenance Guide is required for all landscape projects whether delivered as standalone or in a component set of plans. This plan sheet describes the long-term design intent, limits of landscape maintenance, and the necessary activities for maintaining the planting and irrigation designs.

273.2 Landscape Maintenance Guide Requirements

The Landscape Maintenance Guide provides guidance to the maintaining agency on the anticipated activities necessary to preserve the design intent, assure the vitality of the plant material, and optimize the performance of the irrigation system. Coordinate the methods for plant care and the watering frequency for irrigation systems with the maintaining agency. Include a draft Landscape Maintenance Guide with the Phase III submittal and submit the final guide with the Phase IV submittal. Place the final PDF of the Landscape Maintenance Guide in the:

- Maintenance agreement when maintained by a local agency or group.
- Maintenance contract when maintained by the Department.

273.2.1 Design Intent

Convey the design intent the landscape design is intended to provide.

(1) Functional characteristics of individual plants or groups of plants may:

(a) Screen adjoining land uses

(b) Provide shade to sidewalks or paths

(c) Reduce stormwater velocities (erosion control)

(d) Maintain full foliage, or naturally appearing forest

(e) Reestablish natural roadside edges

(f) Support economic development, or enhance the aesthetics of rest areas

(g) Provide safety enhancements (e.g., roundabout central island, midblock crossings, median treatment)

(h) Preserve required distances, such as:

(i) Stopping and intersection sight distances

(j) Horizontal and vertical clearances near pedestrian facilities

(k) Outdoor advertising sign view zones

(l) Lateral offsets and clear zones

273.2.2 Plant Vitality

Convey the maintenance activities and performance to assure continued plant vitality, such as:

(1) Plant pruning:

(a) Maintain clear trunk to X feet

(b) Maintain at height no less than X feet

(c) Maintain height no greater than X feet

(d) Maintain form and spread

(2) Fertilizer requirements (type and frequency)

(3) Watering requirements

(4) Weeding, mulch replenishment, and planting bed edging

(5) Pest and disease control

(6) Hardscape and site amenities preservation

273.2.3 Irrigation System Performance

Convey the maintenance activities for optimal performance of the irrigation system, such as:

(1) Frequency of scheduled inspections and testing requirements

(2) Requirements associated with the original design parameters, including manufacturer specifications and user manuals

(3) Zone run times based on system efficiency, precipitation rate, seasonal adjustments, and local jurisdictional restrictions

(4) Inspection and maintenance of the following:

(a) Backflow preventers and points of connection

(b) Water sources and pressure requirements

(c) Filters and filtration requirements

(d) Operations of controllers and sensors

(e) Valve flow and operations

(f) Head adjustments and spray patterns, including necessary adjustments as the landscape matures

(5) Winterization requirements (if applicable)

(6) Future audit requirements

273.3 Limits of Landscape Maintenance

Provide an illustration that defines the boundaries of maintenance activities. The illustration is typically not-to-scale and is oriented west to east or south to north (increasing stationing or mile post). The illustration should include the following:

(1) Use the planting plan sheets, “gray-screened” and devoid of unnecessary text and labeling, in the background.

(2) Display and label the limits of maintenance shown as shaded or hatched areas.

(3) Provide a north arrow with NTS, typically placed in the top right corner of the sheet.

(4) Label the following:

(a) Begin and end project limits

(b) R/W and easements

(c) Roadway names

(d) Outside edges of sidewalks, pavements, and other elements that define the boundary of maintenance activities

Include the limits of landscape maintenance as an exhibit in the Landscape Maintenance Guide.

273.4 Landscape Maintenance Cost Estimate

Estimate the annual cost for proposed landscape maintenance activities, including the irrigation system. Consult with the District Landscape Architect and District Maintenance staff when developing the cost estimate. During design, a preliminary cost estimate allows the maintaining agency to evaluate the landscape plan and determine if revisions are necessary.

Include the cost estimate as an exhibit in the Landscape Maintenance Guide.

GENERAL LANDSCAPE NOTES (portion)

PLANT SUPPLEMENTS

- All plant material and palms shall be fertilized with a 12 month slow release top dressing fertilizer with a minor element package to include (but not limited to) calcium, magnesium, sulfur, iron, copper, manganese, molybdenum, zinc and boron.
- All plant materials shall be fertilized at the time of planting and 30 days prior to completion of the establishment period. Notify the Engineer in writing 48 hours in advance of all fertilizer applications.

B & B PLANTING MEDIUM

- Balled and burlapped materials are to be rooted and grown in similar planting medium as the proposed location soil conditions. Clay soil root balls will not be accepted as suitable material in balled and burlapped plant material.
- All balled and burlapped materials shall exhibit white feeder roots protruding from the burlap at the time of delivery.

PLANT CONDITIONS

- Plants that call out for a central leader shall not have presence or past evidence of a central leader being pruned larger than a standard pencil diameter.
- All plants shall not demonstrate significant evidence of previous container confinement. Any indication of root development restriction or excessive roots exposed above the soil surface shall be grounds for rejection.
- All plant materials shall have no lichens, algae or fungi attached on more than 10% of plant.
- All plant materials shall have no Spanish moss (*Tillandsia usneoides*) on or within plant canopy.

TRIMMING

- Trim all trees as indicated on the contract documents. Trim lower branches only. All trimming shall be performed to raise existing tree canopy to minimum of 5’ from ground level. Trimming shall be performed per International Society of Arboriculture (ISA) standards. A final trimming cycle shall be executed prior to end of the establishment period.
- Trim all palms as indicated on the contract documents. Trim dead fronds, fruit and seed stalks as necessary or as otherwise directed by the Engineer. Every 12 months perform aesthetic trimming on all palms up to a “9 to 3” horizontal level. Trimming shall be performed per University of Florida IFAS Extension EDIS standards (http://edis.ifas.ufl.edu/ep443). A final trimming cycle shall be executed prior to end of the establishment period.

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Submit the completed Landscape Opportunity Plan to the Department Project Manager and District Landscape Architect. Place the completed Landscape Opportunity Plan in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation Module (see ***FDM 111.7***).

See ***Exhibit 904-1*** for an example of a Landscape Opportunity Plan roll plot.

904.2 Landscape Opportunity Plan Development

A Landscape Opportunity Plan identifies areas within the upcoming roadway project that should be set-aside or prepared for the future landscape project. Common areas are:

- Areas requested by a municipality
- Median plantings or other safety enhancements
- High-visibility areas or embankments, or areas adjacent to barriers or sound walls

- Scenic highways or areas programmed for Highway Beautification Grants
- Areas indicated in the District's Landscape Branding Document

904.3 Landscape Opportunity Plan Sheet

The Landscape Opportunity Plan sheet provides a plan view of the project illustrating the intent of the future landscape project. This sheet may be produced as a roll plot. Use standard symbols contained in the ***CADD Manual***.

The standard horizontal scale is 1" = 100', however an alternate scale may be approved by the Project Manager.

Provide a legend, notes, and details as needed.

904.4 Required Information

Display aerial photography or available topographic surveys as gray-scaled in the background. Information from a prior construction project may also be used. Display and label elements that are relevant to the future landscape design, including:

- Proposed improvements and existing elements to remain
- Existing vegetation or areas to remain undisturbed
- Wetland jurisdictional lines
- Drainage retention areas
- Utilities
- Outdoor advertising view zones

The Landscape Opportunity Plan provides requirements for the development of the roadway design to support a future landscape design. Locations of landscape opportunity planting areas are typically illustrated in a bubble format which identifies various vegetation groupings in a hatched or colorized manner (e.g., "trees/palms/shrubs", "shrubs only", "buffer plantings").

The Landscape Opportunity Plan should also identify or designate the following:

(1) Essential elements of the landscape design intent.

(2) Anticipated locations of irrigation sleeves. See ***FDM 271.3*** for irrigation sleeve requirements.

(3) Preservation areas. Preserve existing trees and vegetation and natural vistas to the greatest extent possible.

(4) Areas requiring soil amendments. Assure landscape areas will have soils suitable for plant viability.

(5) Areas to be set aside to accommodate future plantings considering visibility, clear zone, site distance requirements, and maintenance. Provide adequate space (both above and below ground) for plant growth. Delineate areas in bubble format and indicate as high, medium, or low priority, such as:

(a) Areas with trees and shrubs for screening distracting views

(b) Trees to frame desirable views

(c) Trees and ground cover areas for stabilization of embankments

(d) Trees to shade sidewalks

(e) Shrubs for pedestrian channelization

(6) Use of Selective Clearing and Grubbing to preserve the existing and future landscape planting areas and to relocate trees.

(7) Display applicable clear zones, horizontal clearances, and setback dimensions on the plans which reflect AASHTO and Department guidelines for landscape installation and maintenance operations.

(8) Indicate potential areas for wildflower plantings.

(9) Objectionable and desired views.

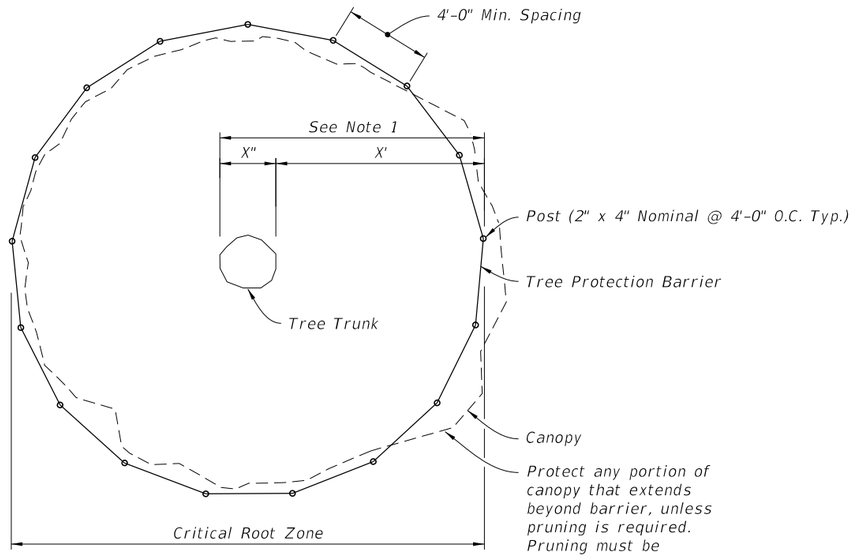
(10) Locations of Outdoor Advertising sign faces and view zones within the project limits; see ***FDM 276***.

904.5 Optional Summary of Analysis

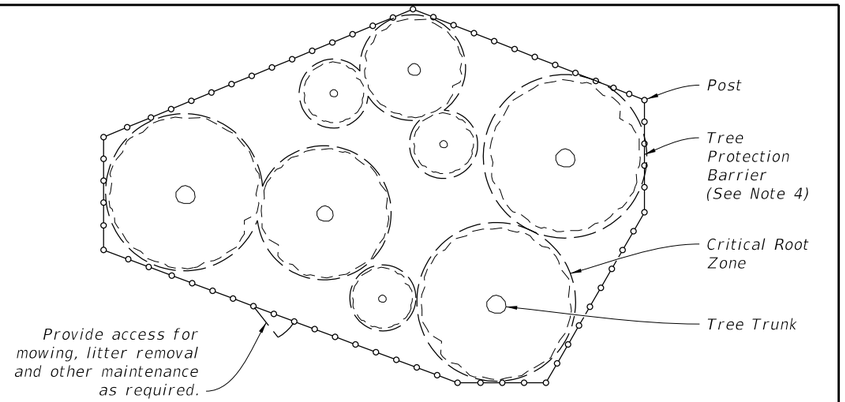
At the District's discretion, provide a Summary of Analysis in a graphic and written format.

NOTES:

1. Critical Root Zone: Extends in all directions from trunk of tree to a distance equal to one foot per inch of trunk diameter at breast height.
2. Staging, storage, dumping, washing and operation of equipment is not permitted within the limits of the tree protection barrier, including during barrier installation.
3. Install all tree protection prior to commencement of construction and remove when directed by the Engineer. Maintain protection at all times.
4. For closely spaced groups of trees, place the tree protection barrier around the entire group.
5. Inspect trunk protection and tree quarterly to prevent girdling. Adjust bands to allow tree growth as needed.
6. See plans for any additional requirements or modifications within the tree protection area.
7. Place weather resistant sign every 50' along the barrier, with 6" minimum text height and provide text in English and Spanish. Sign should read " Keep Out Tree Protection Area".
8. Alternate tree protection systems approved by the Engineer may be used in lieu of the tree protection barrier detailed on this Index as long as the critical root zone is protected.
9. The Critical Root Zone may be reduced, in the field, by a certified Arborist or Landscape Architect.

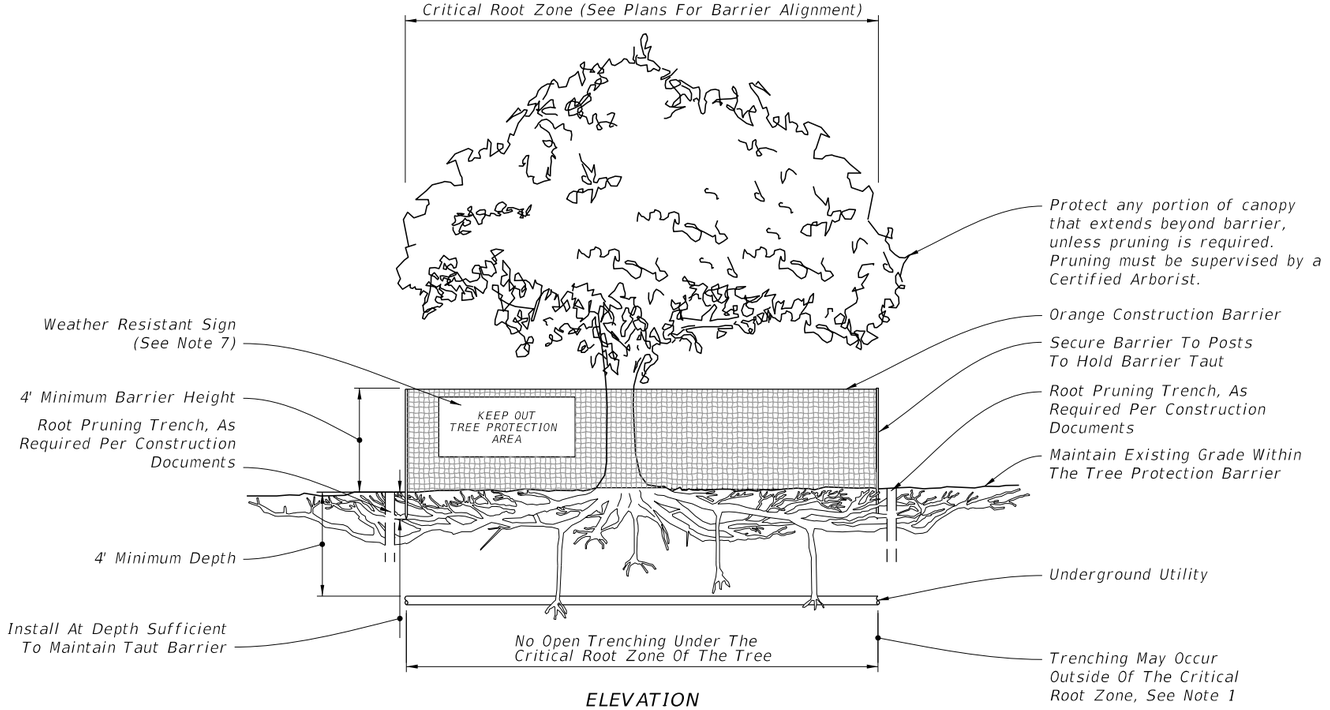


PLAN



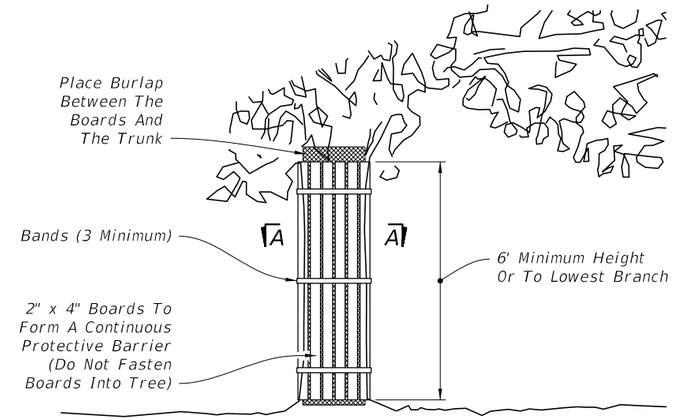
PLAN

PROTECTION BARRIER FOR TREE GROUPINGS

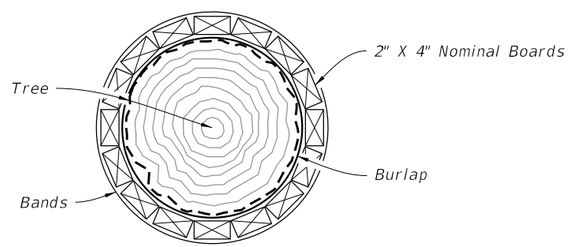


ELEVATION

TREE PROTECTION BARRIER



ELEVATION



SECTION A-A

NOTES:

1. Trunk protection may be used when Tree Protection Barrier can not be reasonably erected, when approved by Engineer.
2. See Selective Clearing and Grubbing Plan for location of trunk protection, when applicable.
3. Adjust bands to allow tree growth (inspect quarterly to prevent girdling).

TRUNK PROTECTION

9/13/2024 7:34:15 AM

LAST REVISION	REVISION	DESCRIPTION:			INDEX	SHEET
11/01/18			FDOT FY 2025-26 STANDARD PLANS	TREE PROTECTION AND PRESERVATION	110-100	1 of 1

6.b Proposed Land Development Procedures Manual Revisions January, 2025

As of 1/17/2025, the SSPAC and CSSSC had approved the proposed changes to the LDPM recommended by the LDPM Working Group.

LDPM, Section 5, Landscape Design Guidelines

5.2.2, Relocation
Added that relocation must be performed in accordance with ANSI A300 guidelines for transplanting.

5.2.3, Tree Types
Removes reference to embedded table showing the Tree Commission approved planting list and references trees approved in the Level 2 Tree Planting Program. Acknowledges periodic updates by the Tree Commission to this list and encourages reference to the Tree Commission website for the most recent version.

5.4.1, Buffer Standards
Requires that tree surveys be performed by a qualified professional, including a surveyor, landscape architect, or certified arborist.

Clarifies that removal of invasive species be performed by either a Natural Areas and Weed Management or Forestry Florida pesticide license.

5.4.2, Landscaping Around Utilities
JEA requested that contractors reference JEA standards rather than LDMP standards for planting around utilities (pump stations, transformers, equipment)

City Standard Specification 601, Landscaping

1.2, Definitions

- M, added plunging roots and roots below the surface of the rootball to "Root Bound" or "Pot Bound" definition
- P, Replaced "Trunk Flare" definition with "The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk".

1.3, Reference Documents
Removed reference to versions of ANSI standards

1.7, Submittals, 1.11, Inspection of Plants Before Installation
Require visible root flares.

2.2, Trees and Palms

Clarification of Florida Fancy definitions, requirements, including branching and trunk flare.

3.16, Pruning
Added ANSI Z60.1 and ANSI A300 standards to requirement.

3.19, Fertilizing
Added ANSI A300 standard

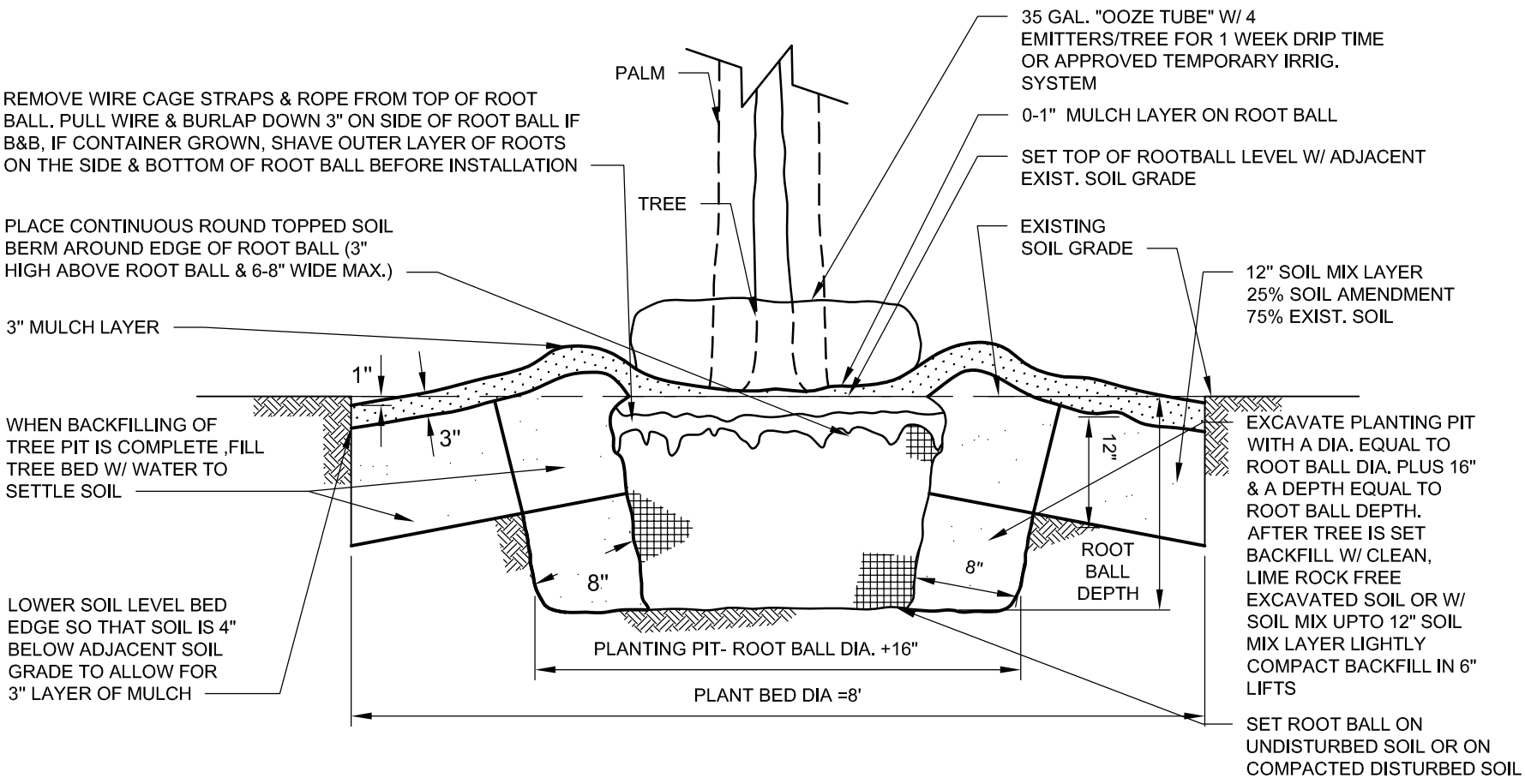
Landscaping Details (Related to Tree Planting)

- L-101, Tree/Palm Planting Detail
- L-102, Rootball Anchoring System
- L-105, Palm Tree Staking in Tree Well

Note, there are other details dealing with tree and root protection

TREE/PALM PLANTING

CITY OF JACKSONVILLE STANDARD



NOTES:

1. ALL TREES AND PALMS TO CONFORM TO FLORIDA FANCY GRADE; ALL OTHER PLANTS TO CONFORM TO FL. NO. 1 GRADE OR BETTER.
2. ANY TREES CAN BE CONTAINER GROWN (CG), BALL & BURLAPPED (B&B) AND TREE SPADED TREE IS EQUAL TO OR GREATER THAN THE BALL SIZE SHOWN IN THE PLANT LIST ABOVE.
3. ALL TREES TO HAVE A SINGLE TRUNK AND PREDOMINATE CENTRAL STRAIGHT LEADER, UNLESS OTHERWISE SPECIFIED AS MULTI-TRUNKED.
4. ALL REQUIRED TRUNKS OF SPECIFIED MULTI-TRUNKED TREES SHALL ORIGINATE FROM THE ROOT BALL.
5. BALLED AND BURLAPPED TREES SHALL HAVE A SOLID ROOT BALL WITH FIBROUS ROOTS THAT HAVE BEEN "HARDENED OFF" FOR A MINIMUM OF 4 WEEKS.
6. ALL CONTAINERIZED TREES SHALL HAVE A SOLID ROOT BALL THE SIZE OF THE SPECIFIED CONTAINER BUT SHALL NOT BE ROOT BOUND

TREE OR PALM PLANTING BED DIAMETER		
*SINGLE TRUNK TREE CALIPER	*SMALL OR MULTI-TRUNKED TREE HEIGHT	*PLANTING BED DIAMETER
1" CAL	4'	6'
2" CAL	6'	8'
3" CAL	10'	8'
4" CAL	12'	10'
5" CAL	14'	10'
6"-7" CAL	18'	10'
PALMS	-	8'

N.T.S.

DATE DRAWN

REVISED DATE

PLATE L-101

ROOTBALL ANCHORING SYSTEM

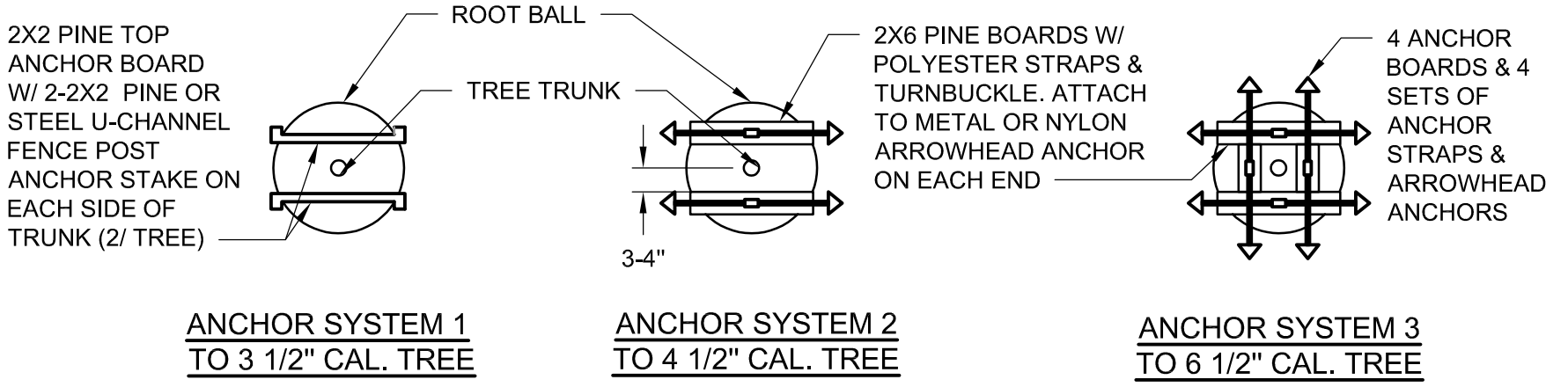
CITY OF JACKSONVILLE STANDARD

N.T.S.

DATE DRAWN

REVISED DATE

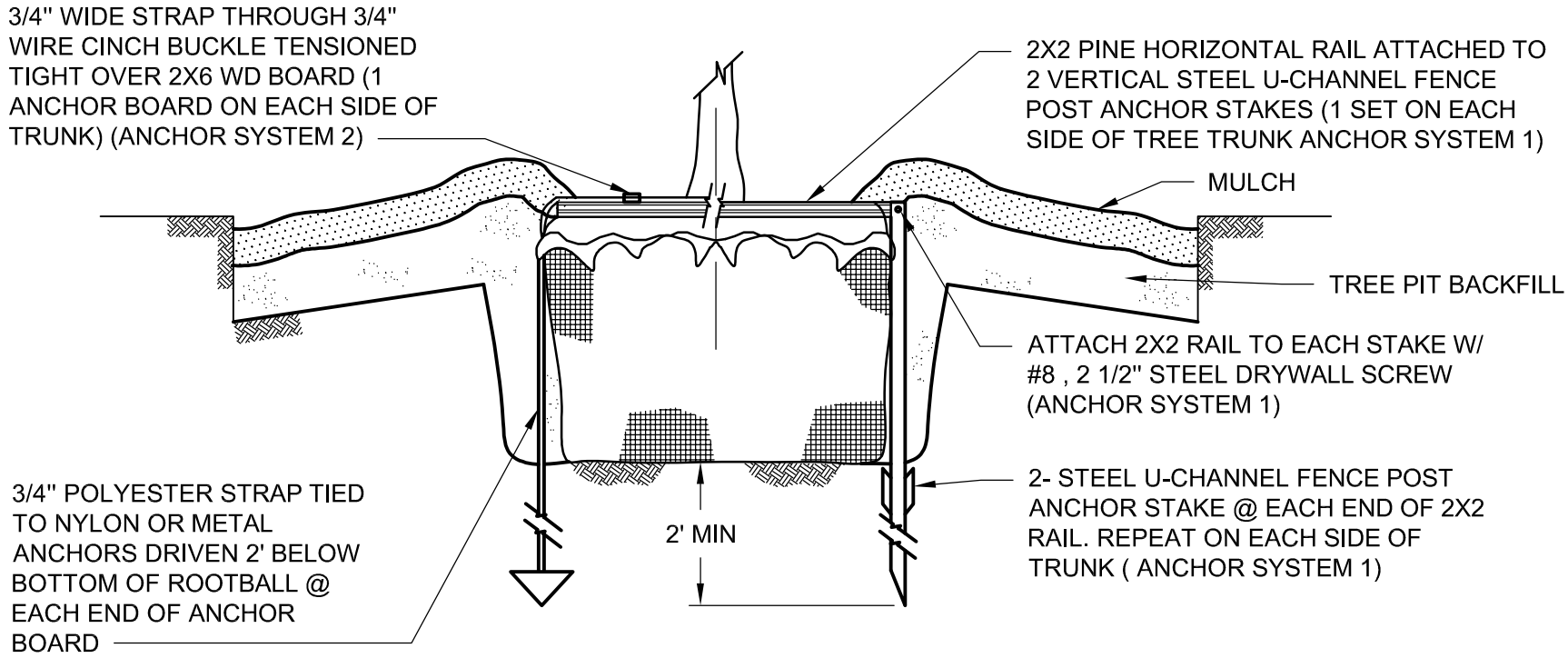
PLATE L-102



ANCHOR SYSTEM 1
TO 3 1/2" CAL. TREE

ANCHOR SYSTEM 2
TO 4 1/2" CAL. TREE

ANCHOR SYSTEM 3
TO 6 1/2" CAL. TREE



SHRUB/GROUNDCOVER PLANTING

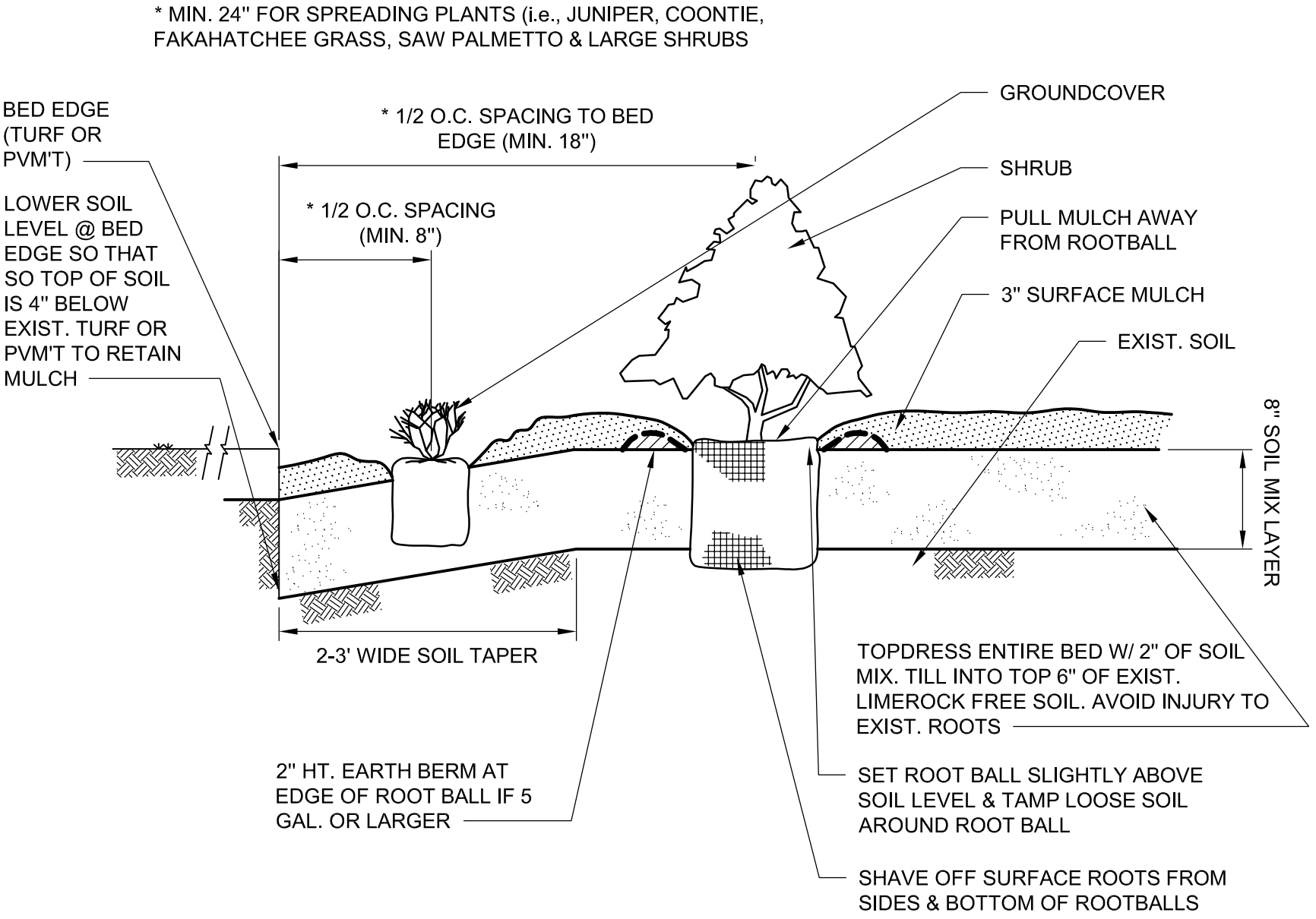
CITY OF JACKSONVILLE STANDARD

N.T.S.

DATE DRAWN

REVISED DATE

PLATE L-103



PAVER BAND DETAIL

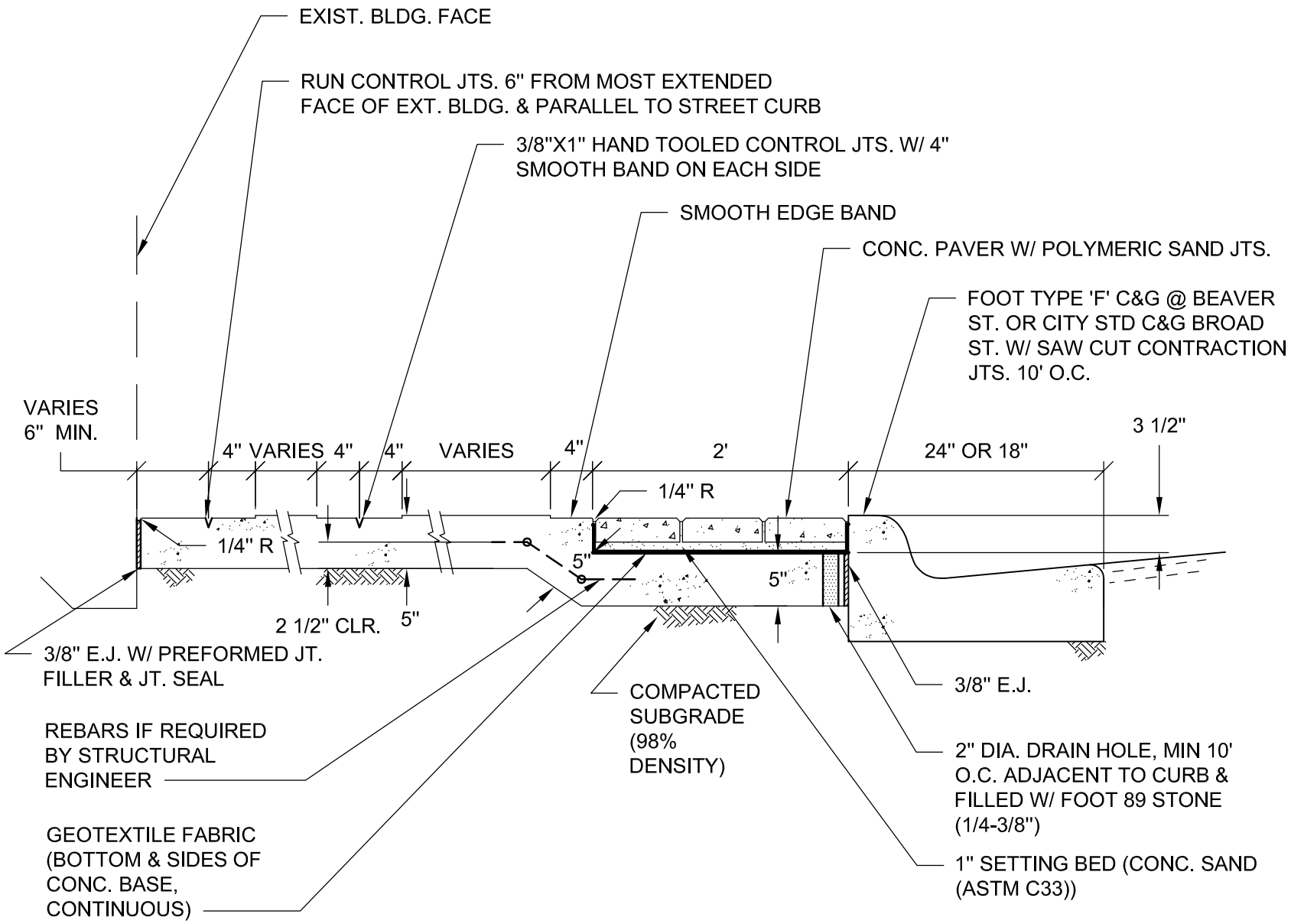
CITY OF JACKSONVILLE STANDARD

N.T.S.

DATE DRAWN

REVISED DATE

PLATE L-104



PALM TREE STAKING IN TREE WELL

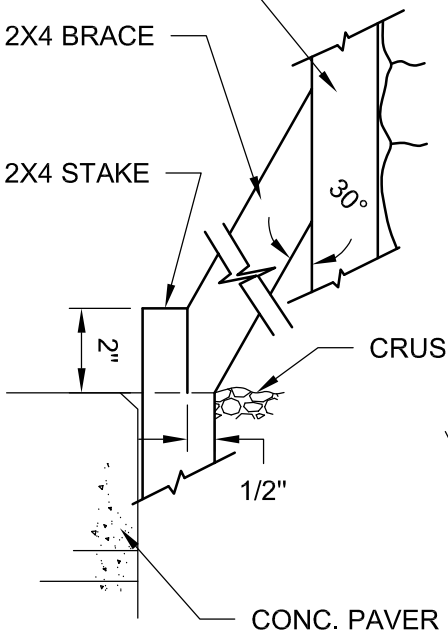
CITY OF JACKSONVILLE STANDARD

1"=1'

DATE DRAWN

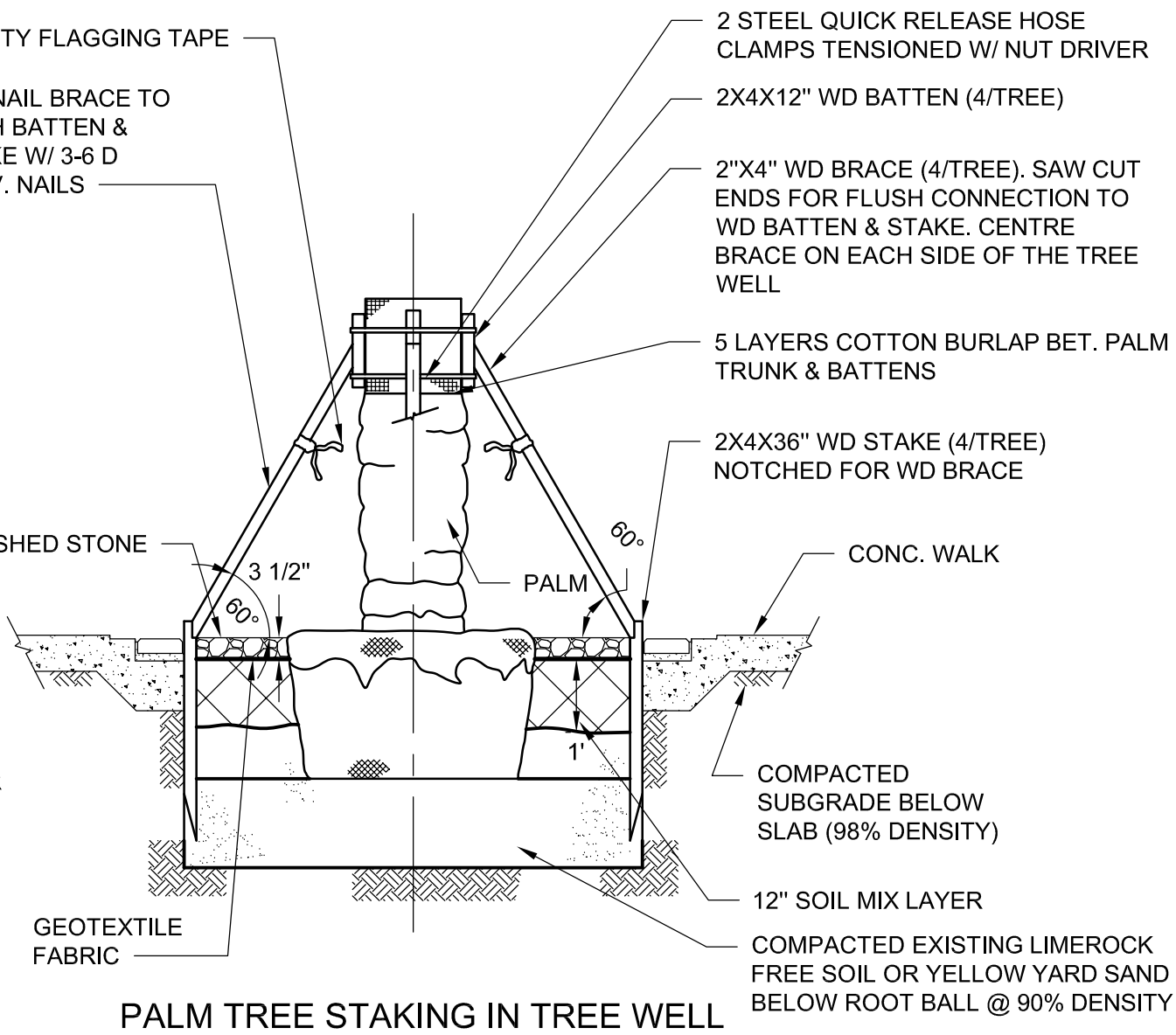
REVISED DATE

PLATE L-105

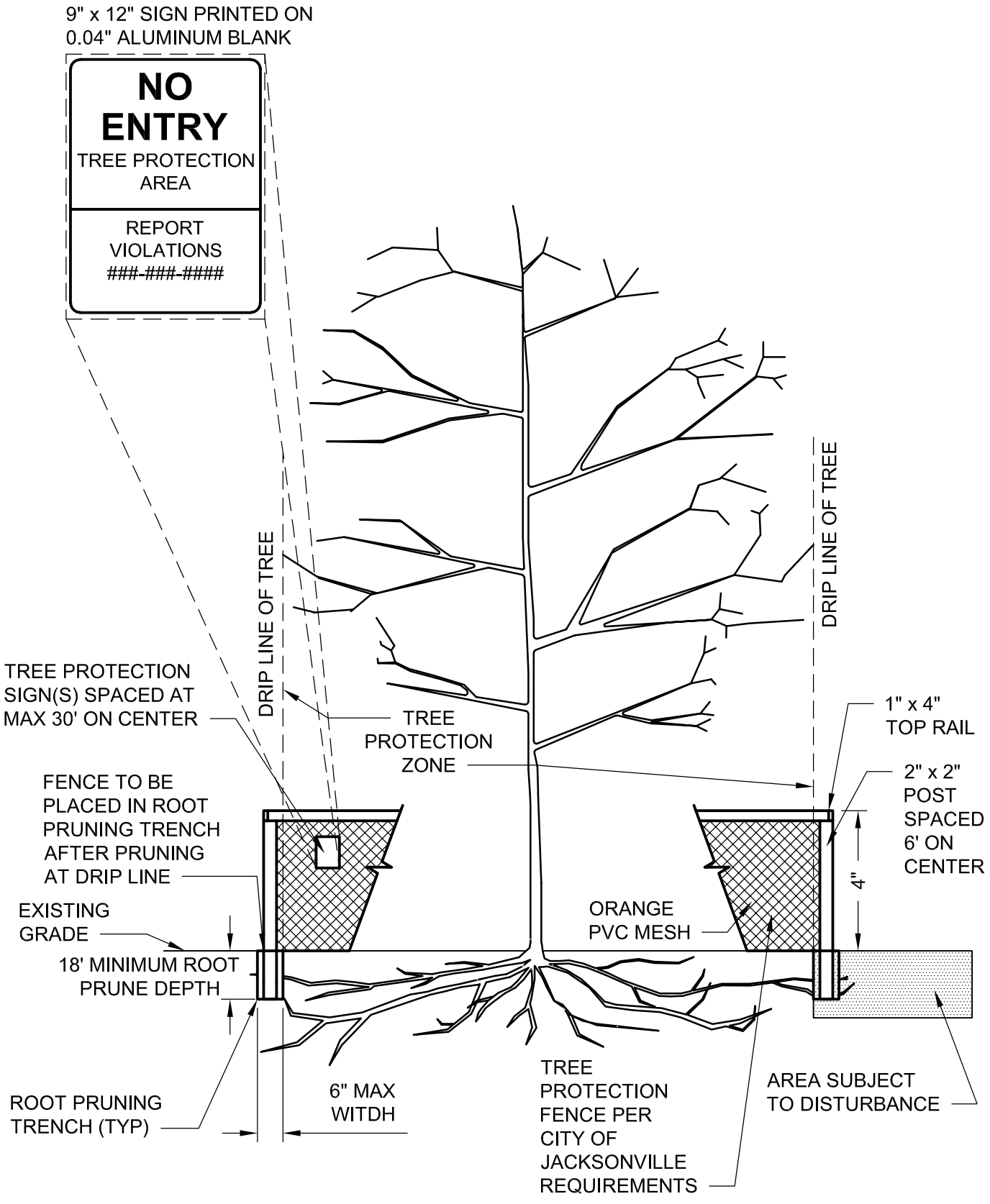


BRACE CONNECTION DETAIL

NTS

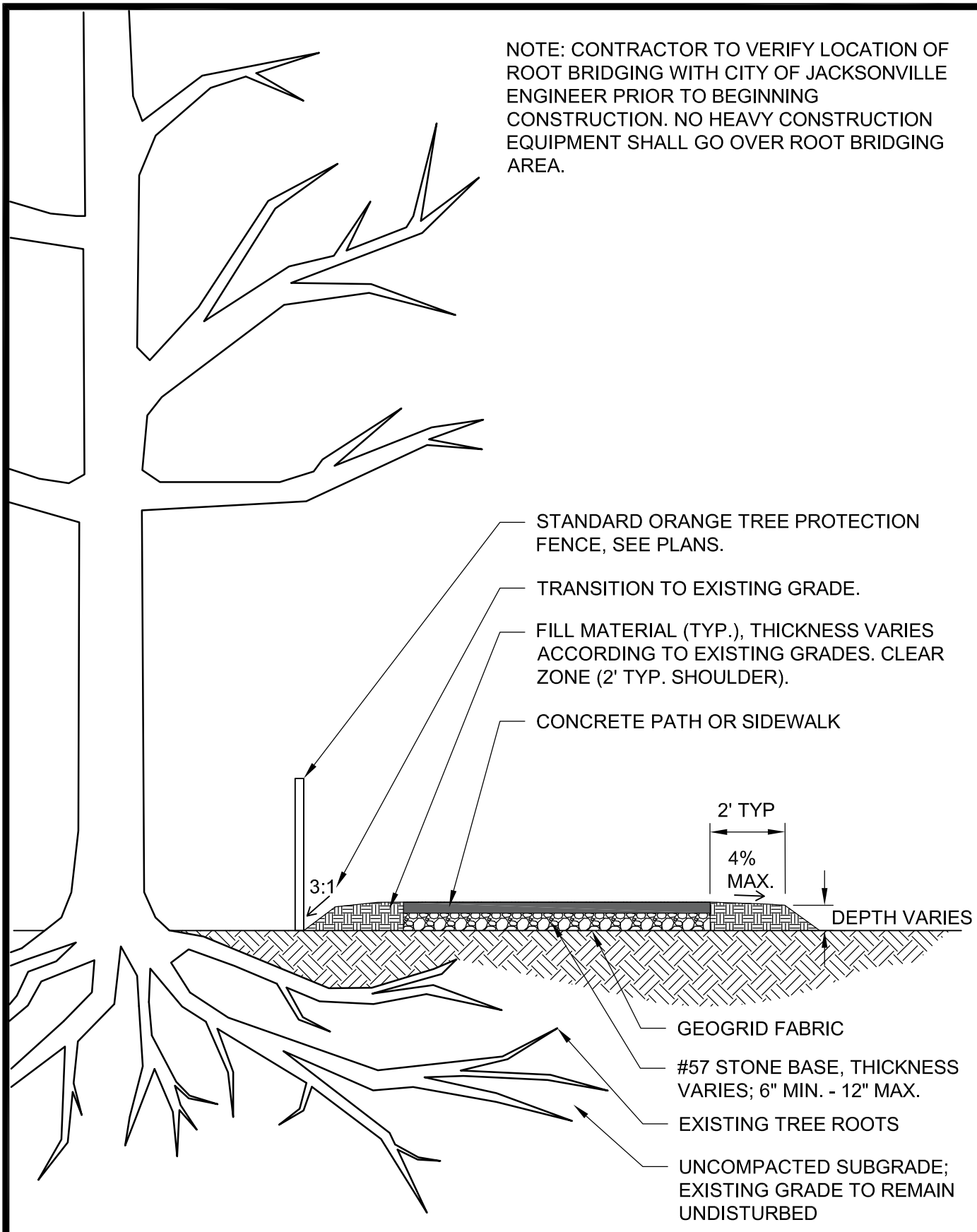


PALM TREE STAKING IN TREE WELL



TREE PROTECTION	CITY OF JACKSONVILLE STANDARD	N.T.S.	PLATE L-106
		DATE DRAWN	
		REVISED DATE	

NOTE: CONTRACTOR TO VERIFY LOCATION OF ROOT BRIDGING WITH CITY OF JACKSONVILLE ENGINEER PRIOR TO BEGINNING CONSTRUCTION. NO HEAVY CONSTRUCTION EQUIPMENT SHALL GO OVER ROOT BRIDGING AREA.



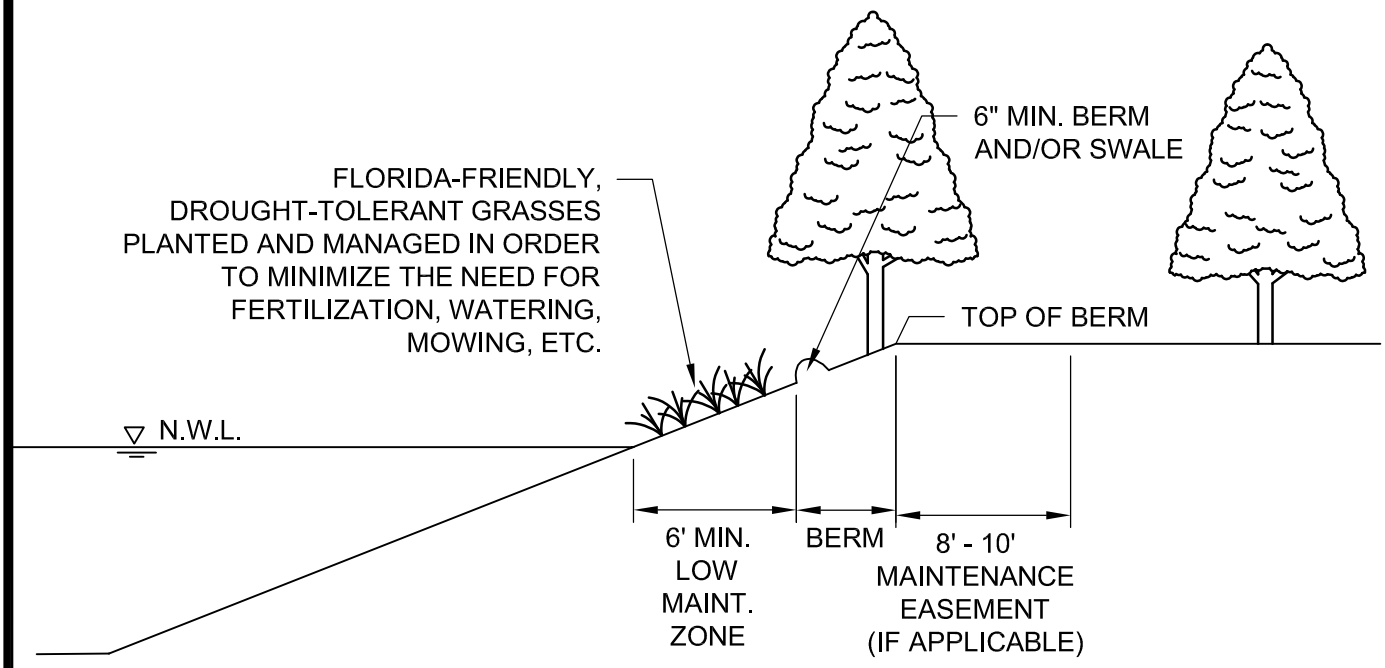
NOTE: LIMITS OF ROOT BRIDGING SHALL BE COORDINATED WITH CITY OF JACKSONVILLE.

ROOT BRIDGING DETAIL	CITY OF JACKSONVILLE STANDARD	N.T.S.	PLATE L-107
		DATE DRAWN	
		REVISED DATE	

NOTES:
1. A SWALE/BERM SYSTEM IS RECOMMENDED FOR INSTALLATION AT THE LANDWARD EDGE OF THIS LOW MAINTENANCE ZONE TO CAPTURE AND FILTER RUNOFF.

2. NO MOWED OR CUT VEGETATIVE MATERIAL SHALL BE DEPOSITED OR REMAINING IN THE LOW MAINTENANCE ZONE OR DEPOSITED IN THE WATER

3. CARE SHOULD BE TAKEN TO PREVENT THE OVER-SPRAY OF AQUATIC WEED PRODUCTS INTO THE LOW MAINTENANCE ZONE.

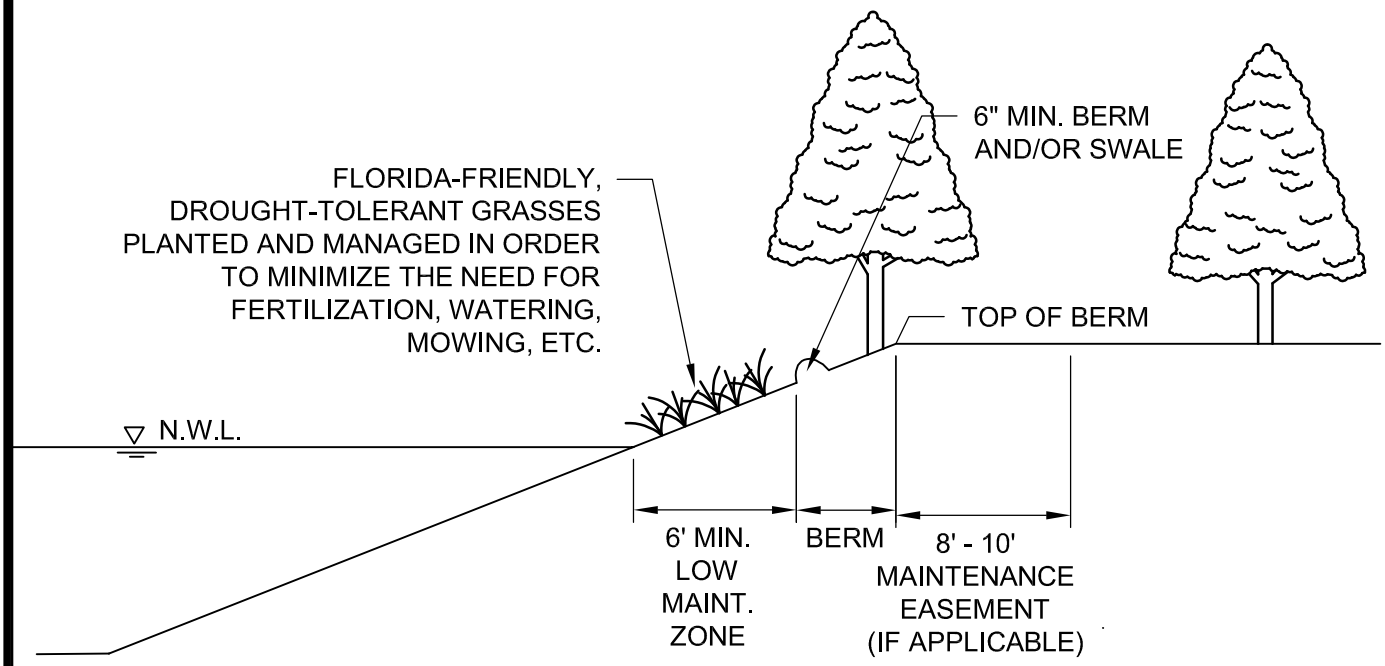


POND LOW MAINTENANCE ZONE (TYP.)	CITY OF JACKSONVILLE STANDARD	N.T.S.	PLATE L-108
		DATE DRAWN	
		REVISED DATE	

NOTES:
1. A SWALE/BERM SYSTEM IS RECOMMENDED FOR INSTALLATION AT THE LANDWARD EDGE OF THIS LOW MAINTENANCE ZONE TO CAPTURE AND FILTER RUNOFF.

2. NO MOWED OR CUT VEGETATIVE MATERIAL SHALL BE DEPOSITED OR REMAINING IN THE LOW MAINTENANCE ZONE OR DEPOSITED IN THE WATER

3. CARE SHOULD BE TAKEN TO PREVENT THE OVER-SPRAY OF AQUATIC WEED PRODUCTS INTO THE LOW MAINTENANCE ZONE.



POND LOW MAINTENANCE ZONE (TYP.)	CITY OF JACKSONVILLE STANDARD	N.T.S.	PLATE L-109
		DATE DRAWN	
		REVISED DATE	

SECTION 601
LANDSCAPING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary to perform all operations required to supply, deliver, and install plants ("landscaping") complete as shown on the drawings and as specified herein.

1.2 DEFINITIONS

A. **"Initial Acceptance" or "Substantial Completion**": The date when the Engineer issues a notice of Substantial Completion after construction work, including punch-list items, has been completed in accordance with of the contract documents and to the satisfaction of the Engineer.

B. **"Final Acceptance":** The point when the landscape maintenance work required after Initial Acceptance, including all punch list items from the Final Inspection, has been completed to the satisfaction of the Engineer.

C. **"Nursery Grown" Plants:** Plants grown in the nursery from liners or collected.

D. **Container Plants:** Plants that are grown in and/or are currently in a container including boxed trees.

E. **"Tree":** Hardwood or conifer trees, not including palms.

F. **"Palm":** an unbranched evergreen tree with a crown of long feathered or fan-shaped leaves, and typically having old leaf scars forming a regular pattern on the trunk.

G. **"Hardened Off" or "Cured" Field Grown Tree or Palm:** Nursery field grown trees that have been dug, balled and burlapped, and then grown for 4 to 52 weeks in the original hole, a new hole or out of the ground in a holding area until fibrous roots are seen growing through the burlap on the sides of the root ball.

H. **"Hardwood or Conifer Tree Caliper":** Diameter of trunk measured at 6" above the ground if the tree has a trunk diameter of 4½" or less and measured at 12" above the ground if the trunk diameter is greater than 4½".

I. **"Palm Caliper":** The diameter of widest portion of the palm trunk measured 3' above the top of the root ball. Existing dead leaf bases or boots are not included in this measurement.

J. **"Cropped" or "Hurricane Cut" Cabbage Palm:** Cabbage palm collected in the wild and then stripped of all leaves before shipment to the job site.

K. **"Regenerated Cabbage Palm":** A collected cabbage palm, which has some type of root ball containment, that is maintained until (1) there are a minimum of 4 new, fully expanded "excellent leaves" and, (2) there are round, whitish-yellow roots with tapered ends that have emerged from all sides of the root ball initiation zone.

L. **"Booted":** The retention of the dead leaf bases that naturally remain affixed to the palm trunk.

M. **"Root Bound" or "Pot Bound":** Root balls from containers which have large or numerous roots encircling the surface of the root ball including plunging roots and roots that are below the surface of the rootball.

N. **"Spaded Trees":** Field grown trees dug, immediately transported, and installed in the final growing site using tree spade equipment.

O. **"Single Leader" Tree"** Tree with one single trunk growing as a single leader to the top of the tree crown.

P. **"~~Root Collar~~Trunk Flare":** The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk~~The point where the top-most structural roots meet the trunk. This location may be associated with a swelling of the trunk depending upon the tree species and age~~.

1.3 REFERENCED DOCUMENTS: The latest editions of the following publications, specifications, and standards, plus addenda, when referenced, form a part of this specification. If the requirements of the referenced documents below conflict with this specification section, the requirements of this specification shall prevail. If the requirements of the referenced documents conflict with each other, then the more stringent requirement as determined by the Engineer shall prevail.

A. Florida Grades and Standards for Nursery Plants, (Grades and Standards) Florida Department of Agriculture and Consumer Services, Division of Plant Industry.

B. ANSI Z60.1~~-2004:~~ American Standard for Nursery Stock.

C. ANSI A~~–~~300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance~~, most current edition and parts~~.

D. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois.

E. City of Jacksonville Ordinance Code, Chapter 366 (Groundwater and Surface Water Resource Management), Part 6- Fertilizer Application.

1.4 REGULATORY REQUIREMENTS

A. Obtain all permits related to landscape work unless previously excluded elsewhere in the contract documents.

B. Comply with all laws and ordinances bearing on the operation of the work as drawn and specified. Promptly notify the Contract Manager in writing if there is a conflict between the regulatory requirements and the work shown in the contract documents. Include, in the written notice, the description of the necessary changes and resultant costs, if any.

C. Comply with regulatory agencies requirements established for fertilizer and pesticide composition.

D. Application of Pesticides: Strictly comply with the manufacturer's specimen label and safety data sheet for each pesticide used, and the pest control regulation of the State of Florida and the EPA. The pesticide application shall not interfere with other construction activities or with the public.

1.5 VERIFICATION OF PLANS

A. All scaled dimensions on the drawings provided for a project are approximate. Therefore, carefully check and verify all dimensions and quantities before proceeding with work. Immediately inform the Engineer of any discrepancies between the information on the drawings and the actual site conditions. Do not proceed with work in areas where discrepancies are found until the Contract Manager has resolved the conflicts and approves work in the affected area.

B. If there is a discrepancy between the plant quantities shown on the plans and the quantities noted in the plant call outs, plant list or plant schedule, then the number of individual plant symbols shown on the plans shall prevail. In multiple plant beds where individual plants are not shown, then the number of plants shall be determined by taking the square footage of each bed area and dividing it by the specified on-center spacing.

1.6 QUALITY ASSURANCE

A. Comply with regulatory agencies requirements established for fertilizer and pesticide composition.

B. Application of Pesticides: Strictly comply with the manufacturer's specimen label and safety data sheet for each pesticide used, and the pest control regulation of the State of Florida and the EPA. The pesticide application shall not interfere with other construction activities or with the public.

C. Ship landscape materials with certificates of inspection required by governmental authorities. All trees and palms shall be FLORIDA NO. 1 or better, as described in the "Florida Grades and Standards for Nursery Plants" and as modified herein.

D. Plant substitutions are not allowed without the Engineer's approval (see Submittals requirements below).

E. Landscape Contractor Qualifications: The Landscape Contractor must have been in business for least the last 5 years and must have successfully completed 3 installations of similar scope during that time.

F. Landscape Contractor's Field Personnel Qualifications

1. Field Supervisor: The field supervisor shall have a minimum of five years' experience as a field supervisor interpreting landscape and irrigation plans and specifications, installing plants of the type, quality, and scale of the proposed project, and who can communicate in English. The field supervisor shall be at the project site when landscape work is in progress.
2. Landscape Crew: The landscape crew shall have a minimum of 3 years' experience in the installation of planting soil, trees, palms and other plants and Irrigation, where applicable.

1.7 SUBMITTALS

A. Landscape Contractor, Field Supervisor, and Field Crew Qualifications: Submit landscape contractor qualifications before award, if requested. Include the date the business was established and a list of three 3 landscape installations of similar scope successfully completed in the past 5 years. Include location; name and address of owner; and date when each project was completed.

B. Nursery Sources: List of nurseries providing plants for the project at the pre-construction conference. Include name and location of each grower and the names and quantity of plants each grower is providing. Submit a photograph taken at the grower's nursery that shows an example of each specified plant species, variety, and size.

C. Plant Substitutions: When a plant as specified is not obtainable, submit at the pre-construction conference proof of non-availability and a written proposal for use of equivalent material.

D. Soil test report of soil with recommendations for pH adjustment of soil.

E. Inspection Certificates, Manufacturer's Data: Submit copies of certificates of inspection required by governmental authorities. Submit manufacturers or vendor's label, certified analysis, and application or installation instructions for the materials noted below. Submit other data requested to substantiate that materials comply with specified requirements. Submit vendors invoice for the materials below, if requested. The invoice shall include the type and quantity of each material delivered to the Contractor.

1. Fertilizers.
2. Pesticides and Herbicides used.
3. Portable water bags and/or the temporary irrigation system components, depending upon what water system is chosen.
4. Tree root ball anchoring and palm staking system components.

F. Plant Certification: Submit the following when requested by the Contract Manager.

1. Certification from each grower providing B & B Trees and Palms for a work order, stating that the B&B Trees and Palms, (except for collected cabbage palms) have been "hardened off" or "cured" before shipment and that the burlap wrap is a natural biodegradable fiber.

2. Certification statement verifying that trees have visible root flares from the grower to the installation contractor. A separate and identical statement should be provided from the installation contractor to the City.

~~1.~~

~~2.~~3. Date Palm Variety Certification: Provide with delivery, the supplier's invoice and the supplier's certificate of date palm variety. Include on the certificate the following statement:

a. I, (name), on behalf of (supplier), certify that the palms sold to (landscape contractor name) on Invoice # _____ are the following variety: genus, _____, species_____, sub-variety _____. signature and date.

G. Samples of Topsoil, Yard Sand, Soil Conditioner, and Mulch. Submit one quart of each item used, if requested.

H. Site Visit reports during the maintenance period.

1.8 ENGINEER'S OBSERVATION OF WORK

A. The Engineer may observe the work at any time and remove samples of materials to determine conformity with the specifications. Immediately remove rejected materials from the site and replace with the specified materials. The Contractor shall pay the cost of testing the materials that fail to meet the specifications.

B. Keep the Engineer informed about the work progress so the work may be observed at the following key times during the landscape construction process. Schedule each site visit in advance with the Engineer. Failure of the Engineer to make field observations does not relieve the Contractor from meeting all the requirements of this specification. Site visits will include the following.

1. Review of soil and drainage conditions before planting preparation.
2. Review of plant layout before plant installation.
3. Review of plant quality either at the time of delivery to the nursery or to the job site.

1.9 NURSERY SOURCES

A. Submit a list of plants that will be provided by each grower, as well as a photograph taken at the grower's nursery that shows a typical example of each specified type and size of tree and palm. Also, submit photographs showing a typical example of other plants listed on the price proposal. Include the name and location of each grower.

B. Include in the photograph of each tree and palm an adult person holding a pole longer than the specified height or spread of the plant and marked in 1-foot increments clearly readable in each photograph. Place pole on top of the root ball when measuring heights.

C. Label each photograph with a complete description of the typical plant shown, including botanical and common name, caliper, height and/or spread, B&B root ball diameter or container size, and other details included in the plant schedule.

D. Include with each group of photographs a statement from the grower that plants supplied will conform to the description attached to each photograph, as well as meet the "Florida Fancy" grade for trees and palms established by the *Florida Grades and Standards for Nursery Plants*. Other plants will conform to the "Florida No. 1" grade or better.

E. Do not ship plants from growers until photographs are approved.

1.10 PLANT SUBSTITUTIONS

A. If a plant specified in the plant schedule becomes unavailable, then submit proof of non-availability at least 30 business days before the scheduled plant installation date. Include a list of nurseries contacted in the search for the originally specified plant.

B. Recommend a substitution for the unavailable plant, the name of the nursery source, and how the plant differs from the original plant specified. The substitution may be a smaller or larger size, a different shape or habit, the same genus and species but different cultivar, or other characteristics that may be different from the specified plant. Include a photograph of a typical plant to be used as a replacement.

C. The Engineer will issue a change order for the approved substitutions. However, such replacements will be at no additional cost to the City.

1.11 INSPECTION OF PLANTS BEFORE INSTALLATION

A. Photograph Submittal

1. Include in the photograph of each tree and palm an adult person holding a pole longer than the specified height or spread of the plant and marked in 1-foot increments clearly readable in each photograph. Place pole on top of the root ball. For other plants, show a close-up photo of each type of plant with a person holding a yard stick measuring the spread and then the height above the root ball.
2. Include with each photograph, a complete description of the typical plant shown, including botanical and common name, caliper, height and/ or spread, B&B root ball diameter or container size, and other details included in the plant schedule. Do not ship plants from growers until photographs are approved.
3. Also include with each group of photographs a statement from the grower that plants supplied will conform to the description attached to each photograph, as well as the following grades established by the "Grades and Standards for Nursery Plants." Trees and palms will conform to the “Florida Fancy” grade and other plants will conform to the “Florida No. 1” grade or better.

B. Plant Inspection at the Contractor’s nursery or at the Job site prior to planting.

1. The Engineer may inspect plant material at the contractor’s nursery and/or at the job site to determine conformance with the specifications. If the Engineer identifies a defect and determines that the defect can be corrected

to conform with the specifications, the Contractor may proceed with the mutually agreed remedy before or after planting, so long as the result is in conformance with the specifications. Otherwise, the defective plant will be rejected.

2. The Engineer may also remove soil from the top of the root ball to determine the depth of the ~~root collar~~trunk flare and presence of encircling roots. Observation may be as frequent and as extensive necessary to verify that the plants meet the requirements of the specifications.

1.12 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged materials: Deliver packaged materials in original containers and protect from deterioration.

B. Plant Shipment

1. Grower shall water root balls just before shipping. Label at least one representative plant of each specified species and variety with a securely attached waterproof tag bearing the botanical and common name, if requested.
2. Ship cabbage palms specified as “hurricane cut” or “cropped” with all fronds removed. Ship regenerated cabbage palms and other palms with dead fronds and fronds below horizontal removed (up to 2/3 of the oldest fronds can be removed). Lift-up remaining fronds in an upright position and tie fronds into a bundle with biodegradable twine. Keep frond bundle tied until after the palm planting is completed and for the additional time recommended by the palm supplier.
3. Provide protective covering over trees and palms during shipment. Tie down trees and palms to the trailer bed to prevent rolling during shipment. Ship other plants in enclosed trucks. Do not bend or bind-tie plants in such a way that will damage bark, break branches, or destroy natural shape. Do not leave plants in trucks parked in the sun during hot weather unless air-conditioned.
4. Do not lift trees by the trunk when unloading. Lift B&B trees under the root ball or by the wire loops if there is a wire basket. Lift large, containerized trees with a forklift under the container. Lift smaller plants by the root ball or by the lips of the container, not by stems or trunks. Keep container grown stock in containers until planting time.
5. Do not free-fall, drag, roll, strain the bud or otherwise abuse palms. Mechanically lift and relocate palms with a protective device around the trunk to prevent damage to the bud and trunk.
6. Place plants in an irrigated holding area either at the grower’s nursery, at the landscape contractor’s yard, or at the project site if plants are stored out of the ground for more than 6 hours. Set plants in an erect position. If B&B,

cover root balls with mulch or straw. Irrigate plants to keep roots moist and to prevent wilting until planting.

7. Deliver plants to the job site only after planting preparations have been completed.

1.13 JOB CONDITIONS

A. Coordination: Coordinate all landscape work with the Engineer and other Contractors. Plant only after final grades are established.

B. Location of Underground Utilities: Determine location of underground utilities before excavating; hand excavate where required to avoid damage to utilities. After the locations of transplanted trees, new trees and beds have been staked, contact utility-locating services at least 72 hours before any excavation. The utility location service for most utilities is the Florida Utility Locating Service at 800-432-4770.

C. Notification of FDOT and City Traffic Engineering: If work is within a street right-of-way, coordinate work and maintenance of traffic with the appropriate agency. If work is within state highway right-of-way, notify the FDOT Inspector Coordinator at 360-5658. If work is located in the City right-of-way, contact the City Traffic Engineer at 387-8894. Notification shall occur at least 48 hours before starting work in the right-of-way.

D. Maintenance of Traffic: Comply with the FDOT Manual of Traffic Control when working in a FDOT right-of-way and with the maintenance of traffic requirements of the City Traffic Engineer when working in a City right-of-way.

E. Clean Up and Protection

1. During landscape work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.
2. Protect vehicular and pedestrian traffic, existing vegetation, above ground and underground utilities and structures during construction by using signs, barricades and/or fencing. In addition, post signs or barricades required by the City. Maintain protection until Initial Acceptance of the landscaping.
3. Protect landscape work from damage by landscape operations, operations by other contractors and trespassers until Initial Acceptance.
4. Maintain grade stakes set by others until all parties agree that the stakes can be removed.
5. Repair or replace all damage to existing improvements caused by the Contractor's operations on the project property, right-of-way, or adjacent property. Repair or replace as directed by the City, and at no cost to the City.

1.14 PLANTING SEASON:

A. Landscape work may proceed at any time or season agreed upon by the Contractor and the Engineer. However, schedule and perform landscape work only when weather and soil conditions are suitable in accordance with local practice. Do not install plant material when temperatures may drop below 35 degrees or above 95 degrees Fahrenheit, nor when wind velocity exceeds 10 miles per hour, unless approved by the Engineer.

B. During periods of extreme drought, the Engineer may instruct the Contract to delay plant installation until the rainfall returns to normal.

PART 2 MATERIAL

2.1 PLANTS

A. Provide state inspected, nursery-grown plants, unless otherwise specified. Plants shall c~~C~~onform to the plant schedule, the "Florida Grades and Standards for Nursery Plants," local landscape ordinance, and, where applicable, to ANSI Z60.1. Trees and Palms shall conform to the FLORIDA FANCY grade; all other plants shall conform to the FLORIDA NO. 1 grade or better.

B. Provide healthy, vigorous plants with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal for the specified plant. Plants shall be free from disease, insects and injury; well branched; with a solid healthy root ball of vigorous, fibrous roots, but not excessively root bound. Plants shall have green, live foliage, except deciduous plants when planted in the dormant season.

C. Provide plants that are true to variety, cultivar, species, quality, size, and flower color.

D. Plants installed during the growing season that show signs of “shock” (plants with dead or dying leaves) soon after planting are subject to rejection.

E. Plants that do not conform to the referenced standards shall be rejected. Plants that have been cut back from larger sizes to meet certain specified requirements are also subject to rejection unless approved by the Engineer.

F. Plants larger than specified may be approved by~~to~~ the Engineer, but at no increase in the contract price. If larger plants are accepted, provide root ball size to meet the requirements of the Grades and Standards. Larger root balls will not be acceptable if the resulting root ball cannot fit into the required or available planting space.

G. If the Engineer approves the substitution of a smaller plant than specified, then a credit will be due the City.

H. Container Plants: Provide healthy, vigorous, plants with a well-established root system reaching the sides of the plastic or wood container that will maintain a firm root ball after removal from the container but shall not be root bound (excessive root growth encircling the inside of the container). Root-bound plants will be rejected unless corrective root pruning is approved by the Engineer. Container size shall conform to the "Florida Grades and Standards for Nursery Plants" for each size and type of plant.

2.2 TREES AND PALMS

A. General

1. Trees and palms may be specified as container grown, balled and burlapped, or tree spaded; other plants are to be container grown.
2. Trees and palms with wounds or bark injuries on the major trunks will be rejected.
3. Single Trunk Trees and Palms: Provide trees and palms with single, straight trunks unless otherwise specified as multi-trunk. The specified trunk caliper is the minimum acceptable caliper size.
4. Multi-trunk Trees and Palms: The specified number of trunks of multi-trunk trees and palms shall originate from the root ball. The specified trunk caliper is the minimum acceptable caliper size of each trunk.
5. Balled and Burlapped (B&B) Trees and Palms

    a. Provide field grown balled and burlapped trees and palms firmly wrapped with biodegradable twine, burlap cloth, and a wire basket.
    b. The grower shall dig trees and palms and then hold them at the grower's nursery until the plants are "harden-off or "cured" prior to shipping. Dig plants with a firm root ball. Provide ball sizes complying with the "Grades and Standards for Nursery Plants" unless otherwise specified. Plants with cracked or loose balls will be rejected.

6. Spaded Trees and Palms: Provide trees spaded from a commercial nursery field. Use tree spades capable of appropriately moving trees up to the caliper shown. Dig plants with firm balls of earth sufficient in diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Increase root ball diameter to at least 8" greater than the sizes recommended by the "Grades and Standards for Nursery Plants," unless otherwise specified.
7. Fabric Container Grown Trees: Fabric container grown trees are not allowed.

B. TREES: Provide a "Florida Fancy" tree conforming to the following.

1. Single Trunk Tree: A tree with a single, relatively straight, vertical trunk of the specified caliper growing with a single leader with subordinate limbs to the top of the tree crown unless specified as multi-trunked. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present. The specified trunk caliper is the minimum acceptable caliper size. If the trunk divides into 2 equal diameter stems in the top 10% of the tree, the tree is still considered Florida Fancy. A tree specified as single trunk with multiple leaders in the lower 90% of the tree height will be rejected.
2. Multi-trunked Tree: A tree with the specified number of trunks, each trunk originating from the root ball and extending to about the same height as the other trunks to create a uniform shaped crown. The Contract Manager may approve additional trunks, if requested.
3. Trunk
    a. Free of wounds (other than properly made pruning cuts) that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).
    b. Caliper and taper are sufficient so that the lower five feet of the trunk remains vertical without a stake. An auxiliary stake may be used to maintain a straight leader in the upper half of the tree.
    c. Tree clear trunk is not more than 40% of the total tree height.
4. Tree Crown: The form and density of crown is typical for a young single trunk or multi-trunk specimen of the species or cultivar.
5. Leaves: The size, color, and appearance of leaves is typical for the time of year and stage of growth of the species or cultivar. Tree shall not show wilted, shriveled or dead leaves, which is an indication of prolonged moisture stress or over watering.
6. Branching:
    a. ~~Shoot growth~~Limb taper (length ~~and~~ relative to diameter) throughout the crown is appropriate for the age and size of the species or cultivar.
    b. Tree is free of dead, diseased, broken, distorted, or otherwise injured branches.
    c. Branch diameter is no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
    d. The major lateral branches (scaffold branches) are free of "V' crotches of included bark where the branches are attached to the trunk, or

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where two main trunks are attached. Trees of small or medium ultimate size that produce numerous V crotches (i.e. winged elm, Chinese elm, crepe myrtle, etc.) may be accepted. ~~Trees with a natural growth habit that produce numerous V crotches (i.e., winged elm, Chinese elm) may be accepted~~.

7. Roots:

   a. Roots are reasonably free of scrapes, broken or split wood and injury from biotic (insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents.
   b. There are a minimum of three structural roots reasonably distributed around the trunk (not clustered on one side); two of the structural roots reaching the edges of the root ball.
   c. The ~~root collar~~trunk flare is ~~no more than 2 inches below the root ball soil~~ visible at the grade of the root ball soil.
   d. The root system is reasonably free of stem girdling roots or kinked roots.

C. PALMS: Provide "Florida Fancy" palms conforming to the following:

1. A Single, straight trunk with the specified clear trunk height measured from the original soil line to the point in the canopy where the trunk caliper begins to taper abruptly. **Measure palm trunk caliper 3 feet above the top of the root ball.** The practice of either burying taller palms below the original soil line of the root ball or raising short palms by exposing part of the root ball above the original soil line to achieve the specified height is not allowed. Ship cabbage palms with a "hurricane cut," unless specified as a "regenerated" cabbage palm."
2. Palm Minimum Leaf Count and Root Ball dimension (Florida Fancy Grade): A minimum leaf count of excellent leaves and root ball measurements listed below unless modified by the plant schedule. Palm root ball measurement is the horizonal distance from the lowest part of the trunk or trunks exclusive of exposed roots or persistent leaf bases to the outside edge of the root ball. The total root ball diameter is the trunk diameter at the lowest part of the trunk plus two times the root ball dimensions shown below.

   a. Sabal Palmetto, Cropped: No leaves and 2-inch root ball measurement.
   b. Sabal Palmetto, Regenerated: Minimum 4 leaves and 4-inch root ball measurement.
   c. Washingtonia Robusta: Minimum 8 leaves and 12-inch root ball measurement
   d. Phoenix dactylifera: Minimum 29 leaves and a 12-inch root ball measurement.

e. Phoenix decora or decipiens: Minimum 29 leaves and a 12-inch root ball measurement.
f. For other palms refer to Table 1 in the Florida Grades and Standards for the minimum leaf count and root ball measurement.

3. A minimum root ball depth of 3.5 feet. Provide palm root balls with a flat bottom perpendicular to the trunk.

2.3 TOPSOIL

A. Fine sand or loamy fine sand indigenous to the area suitable for plant growth that is free of weeds, roots, stumps, rocks larger than ½" diameter, organic muck, hard pan, toxic substances detrimental to plant growth, and construction debris such as limerock, concrete, and asphalt pieces. Deliver in a normally moist condition, neither muddy nor wet. Soil used for topsoil shall meet the following criteria measured in accordance with the appropriate AASHTO and ASTM standard:

1.	USDA Texture:	Fine Sand, Loamy Fine Sand
2.	AASHTO Classification:	A-3
3.	pH	5.0-7.5
4.	Deleterious Material	0-2% maximum by mass
5.	(rocks, roots, sod)	
6.	Organic Matter Content	1-10% by mass
7.	Sand Content	80-96% by mass
8.	Silt & Clay Content	3-10% by mass

B. Submit a one-quart sample of the topsoil to the Engineer before beginning planting and obtain approval. If requested by the Engineer, submit a soil test report from a commercial soil testing laboratory to verify compliance with the above criteria.

2.4 EXISTING SOIL: Use existing soil in plant pits if the soil complies with the standard for topsoil, unless the soil is contaminated with limerock, clay, brush, weeds, roots, stumps, stones larger than 1 1/2 inches in any dimension, litter and other extraneous or toxic matter harmful to plant growth. Remove contaminated soil and replace with acceptable stockpiled existing soil or new topsoil.

2.5 YARD SAND: Coarse, clean yellow sand, commonly called "yard sand" that is free of limerock, clay, silt, brush, weeds, roots, stumps, gravel, litter and other extraneous or toxic matter harmful to plant growth.

2.6 SOIL CONDITIONER: Provide 100% organic soil conditioner, free of limerock, clay, brush, weeds, roots, stumps, gravel, litter and other extraneous or toxic matter harmful to plant growth. Soil conditioner shall be one of the following:

A. Pine Bark Fines. 100% pine bark fines screened from other pine bark products.in accordance with standards of the Mulch & Soil Council (Web: www.mulchandsoilcouncil.org) with a maximum of 15% pine wood content and at least 90% of particle size 1/4" or less.

B. Compost: A commercially blended and ground mixture of yard waste, tree trimmings, manure, and other biodegradable materials composted at a temperature and for the time necessary for the biological decomposition of the material, which significantly reduces the viability of pathogens and weed seeds, stabilizes carbon, produces high fungal material to benefit plant growth. Compost shall meet the following US Compost Council STA/MECC criteria.

Stability:	≤2 mg CO2-C per G OM per day
Maturity:	90-100% seed emergence and vigor
Moisture Content	35-60% wet weight
Organic Matter Content	35-60% dry weight
Particle Size	3/8"-1/2" screen size to pass through
pH	6.0-7.5
Soluble Salts	Max. 5 dS/m (mmhos/cm) dry weight basis
Physical Contaminants	≤0.5% dry weight basis
Chemical Contaminants	meet or exceed US EPA Class A standard, 40CFR § 503.13 Tables 1 and 3
Biological Contaminants	meet or exceed US EPA Class A standard 40CFR § 503.32(a)

C. Soil Mix: Soil Mix #3 by "Mulch Masters, Inc. Landscape Supply Company" or approved equal.

2.7 FERTILIZER

A. General Use: Granulated commercial grade fertilizer with a ratio of nitrogen (N), phosphorous (P), and potassium (K) recommended by the soil test. The fertilizer shall contain minor elements of iron (Fe), manganese (Mn), and sulfur (S), and trace amounts of zinc (Zn), copper (Cu) and boron (B). Provide 30-50% of N in slow-release form. If a soil test is waived by the Engineer, then the fertilizer shall contain a ratio of N/P/K close to 1/0/1.

B. Palm Fertilizer: Commercial grade fertilizer of nitrogen (N), phosphorous, (phosphate) (P), potassium (potash) (K) and magnesium (Mg) in a ratio of 8/4/12/4 or 8/2/12/4. The fertilizer shall also contain 1-2% iron (Fe), 1-2% manganese (Mn)

and trace amounts of Zink (Zn), copper (Cu) and boron (B). Provide 50% of N, K and Mg in slow-release form.

2.8 SURFACE MULCH: Wood and/or bark mulch free of weed seeds, and other organic or inorganic materials. Provide mulch noted on the drawings. If not noted on the drawings, then the mulch can be one of the following.

A. Pine Bark: Ground bark nuggets derived from the genus Pinus with particle size from 0.75" to 1.75" and maximum wood content of 15%.

B. Pine Straw: Pine needles harvested from pine grooves and then baled with a maximum wood content of 5%.

C. Eucalyptus Mulch: Shredded and screened wood and bark of the genus Eucalyptus with no fillers or sawdust.

D. Melaluka Mulch: Wood and bark of the melaleuca quinquenervia tree shredded and chipped to a particle size not larger than ¾ inch diameter and a length of 1½" and then cured at a high temperature to kill seeds. Bark content not to exceed 10% by volume. Provide *Florimulch* manufacture by Forestry Resources Inc. or approved equal.

2.9 ROOTBALL ANCHORING SYSTEM

A. Anchor System 1:

1. Four 2 x 2 untreated pine posts, pointed on one end or four steel u-channel fence posts with a length equal to the depth of the root ball plus 2 feet into undisturbed soil.
2. Two 2 x 2 untreated pine horizontal anchor boards with a length equal to the diameter the root ball.
3. 3" long galvanized wood screws to connect the stakes and the horizontal boards.

B. Anchor System 2 and 3:

1. "Terra Toggle" Root ball Anchor System by *Tree Stake Solutions* (407) 913-7077 or approved equal.
2. Each anchor includes: two plastic or metal toggles rated at 1000 lb. pull out strength, a ¾" wide, orange UV stabilized woven polyester strap rated at 2400 lb. break strength, one ¾" dichromate coated wire cinch buckle, and one 2 x 4 or 2 x 6 untreated pine plank with a length equal to the diameter of the root ball.

3. Installation tools: tensioning tool, metal water jet, or drive rod driven with slide hammer.

2.10 GUYING AND STAKING MATERIAL – SLOPES OF 4:1 OR GREATER

A. Tree stakes: Three 15" steel eye anchors, 1" dia. eye opening

B. Guy Straps: Green, 3/4 inch wide flat woven green polypropylene straps with a 900 lb. break strength. Use "ArborTie" manufactured by *Deep Root Green Infrastructure* (info@deeproot.com) or approved equal.

2.11 PRE-EMERGENT OR POST-EMERGENT HERBICIDE: Granular or liquid herbicide approved by the Engineer that will control annual grasses and many broadleaf weeds and that is labeled safe for use with the plants in the project.

2.12 NON-SELECTIVE HERBICIDE: Non-selective liquid herbicide, such as 'Roundup, that will kill live vegetation and roots.

2.13 PORTABLE WATERING BAG: Nylon-reinforced, 12mil, UV treated polyethylene portable watering bag or other alternative watering bag system which is wrapped around the trunk of a tree or palm that can slowly apply a minimum of 15 gallons of water through slow-release emitters with each application.

2.14 TEMPORARY IRRIGATION SYSTEM: A run of PVC pipe and emitters with a water truck connection constructed to deliver water from the water truck to a cluster of installed plants. System is typically removed at the end of the maintenance period.

2.15 WATER

A. Provide water of suitable quality for healthy plant growth.

B. If a new automatic irrigation system is included with the construction of the landscaping, then the contractor shall pay for all irrigation water consumption during construction and until Initial Acceptance of the landscaping. The City shall pay for irrigation water consumption beginning on the date of Initial Acceptance, during the plant establishment period and until Final Acceptance of the landscaping.

C. If landscaping is not covered by a permanent irrigation system, the contractor shall pay for all irrigation water consumption during construction, through the Initial

Acceptance of the landscaping, during the plant establishment period, and until Final Acceptance.

PART 3 EXECUTION

3.1 PLANT BED LAYOUT AND INSPECTION:

A. Notify the Project Manager 5 business days before the scheduled plant layout. Do not begin planting work until the layout is approved.

B. Identify with wood stakes, survey flags, or paint the location of each individual tree and palm and the limits of multiple plant beds. When completed, request a layout inspection by the Engineer. Make minor adjustments to the layout requested by Engineer during the inspection.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged materials: Deliver packaged materials in original containers and protect from deterioration.

B. Plant Shipment

1. Grower shall water root balls just before shipping. Label at least one representative plant of each specified species and variety with a securely attached waterproof tag bearing the botanical and common name, if requested.
2. Ship cabbage palms specified as “hurricane cut” or “cropped” with all fronds removed. Ship regenerated cabbage palms and other palms with dead fronds and fronds below horizontal removed (up to 2/3 of the oldest fronds can be removed). Lift-up remaining fronds in an upright position and tie fronds into a bundle with biodegradable twine. Keep frond bundle tied until after the palm planting is completed and for the additional time recommended by the palm supplier.
3. Provide protective covering over trees and palms during shipment. Tie down trees and palms to the trailer bed to prevent rolling during shipment. Ship other plants in enclosed trucks. Do not bend or bind-tie plants in such a way that will damage bark, break branches, or destroy natural shape. Do not leave plants in trucks parked in the sun during hot weather unless air-conditioned.
4. Do not lift trees by the trunk when unloading. Lift B&B trees under the root ball or by the wire loops if there is a wire basket. Lift large, containerized trees with a forklift under the container. Lift smaller plants by the root ball

or by the lips of the container, not by stems or trunks. Keep container grown stock in containers until planting time.

5. Do not free-fall, drag, roll, strain the bud or otherwise abuse palms. Mechanically lift and relocate palms with a protective device around the trunk to prevent damage to the bud and trunk.
6. Place plants in an irrigated holding area where plants are protected from sun and wind whether at the grower's nursery, at the landscape contractor's yard, or at the project site if plants are stored out of the ground for more than 24 hours after delivery to the Contractor or to the site. Set plants in an erect position. Cover root balls of B&B plants with mulch or straw. Irrigate plants to keep roots moist and to prevent wilting until planting.
7. Deliver plants to the job site only after the planting preparation for a landscape area has been completed and when there is adequate storage space for the delivered landscape material. If a suitable remote staging area is needed, provide at no additional cost to the City.

3.3 COMMENCEMENT OF LANDSCAPE WORK: Commence landscape work once the following tasks are complete.

A. the permanent irrigation system is operational in the areas to be planted or an approved alternative means of watering has been provided.

B. The Engineer has inspected and approved the plants either at the holding area or job site.

C. The Engineer has approved the plant layout or has waived the inspection.

D. Work by others that may damage the landscaping is completed.

E. Work necessary for proper landscape installation is completed.

3.4 TREE PLANTING DEMONSTRATION: Before planting begins, the Engineer will select a tree planting site shown on the landscape plan for a demonstration tree planting. With the Engineer present, demonstrate the ability to install a tree in accordance with the planting specifications, including soil replacement, soil amendments, root ball correction, (removal of soil and roots above ~~root collar~~trunk flare and deflected structural roots), placing tree, backfilling, watering, root ball anchoring, and mulching. After requested adjustments are made, this tree will be used as a standard for all other tree planting. If site conditions require the planting of trees on mounds in areas with poor drainage or on slopes 4:1 or greater, a demonstration tree planting for each condition is also required.

3.5 CORRECTION OF SOIL COMPACTION DURING PLANT DELIVERY AND INSTALLATION:

A. Minimize soil compaction in landscaped areas during delivery to planting sites, digging plant holes, and installing plants.

B. Complete the installation of trees and palms before soil preparation and tilling if heavy mechanized equipment is used for delivery and planting.

3.6 CORRECTION OF CONDITIONS DETRIMENTAL TO PLANT GROWTH

A. When conditions detrimental to plant growth, such as poor drainage, hardpan of clay or silt, rubble fill, obstructions, limerock, petroleum products, and construction debris are encountered during the landscape work, cease landscape work in the affected area and immediately notify Engineer.

B. After the Engineer's review, excavate the area of contaminated soil to the depth approved by the Engineer. If the soil is contaminated by the Contractor's construction operations, then remove and replace with topsoil or yard sand at no additional cost to the City. If contaminated soil is discovered that appears by the Engineer to be pre-existing before the beginning of construction operations, and not identified for removal by the contract documents, then the cost of removal of contaminated soil and replacement with new topsoil or yard sand will be in accordance with the price established by the contract documents.

3.7 REMOVAL OF EXISTING VEGETATION AND DEBRIS IN PLANT BEDS

A. Remove bottles, boards, construction materials, limerock, and other debris to a depth of 6 inches inside all plant beds.

B. If there is no vegetation in plant beds, proceed to bed preparation.

C. Remove existing vegetation throughout the entire limit of multiple plant beds and within the required circumference of each individual tree or palm bed.

D. In plant beds free of surface roots from existing trees remove existing vegetation with a sod cutter or other equipment with blades of sufficient depth to remove the entire plant and root system in one operation. DO NOT REMOVE EXISTING VEGETATION WITH A ROTOTILLER OR OTHER MACHINE THAT WILL BREAK THE ROOTS IN SMALL PIECES DURING THE OPERATION.

E. Where living vegetation still remains in the new plant beds containing extensive surface roots of existing trees, remove all top growth and roots of existing vegetation in a manner that will not damage existing tree roots.

F. Do not remove existing vegetation with a rototiller or other machine that will break the roots into small pieces.

3.8 EXCAVATION OF EXISTING SOIL IN PLANT BEDS WITHIN MEDIANS AND PARKING LOT ISLANDS

A. Excavation of Tree & Palm Plant Beds: After a plant bed is clear of all vegetation, excavate the existing soil within each individual tree or palm location to the depth of the root ball less 2" and a width equal to the root ball diameter plus 24". and multiple plant bed so that the soil level in the bed is 12" below the finish level of the adjacent turf, pavement, or curb. Remove surplus soil, limerock, stones over 1½", sticks, roots, rubbish, and other extraneous matter exposed by this operation. Extend excavation below the location of each tree as detailed if the root ball vertical dimension is greater than 26".

B. Excavation of Plant Beds in Medians and Parking Lot Islands: Extend excavation of existing soil to a depth of 24 inches.

C. Notify the Engineer if the existing soil at the bottom of the tree pit is contaminated with limerock or other debris detrimental to plant growth. After the Engineer's review, excavate the contaminated soil underneath each tree root ball equal to the diameter of the root ball plus 2' and to the depth approved by the Engineer. Remove and replace with yellow sand or topsoil. Soil replacement shall be paid at the unit price established in the proposal.

3.9 PLANT BED PREPARATION

A. After the existing soil has been removed, backfill each bed with topsoil so that the topsoil layer is 17" deep. Adjust the level of the topsoil by excavation or by the application of additional soil in plant beds so that after the application of the soil conditioner, and grading, the soil mix layer at the edge of the beds is 4" below adjacent turf, pavement, or curbs.

B. Spread soil conditioner throughout all individual and multiple plant beds to a minimum depth of 3" (9.2 cub. yds. per 1000 sq. ft.). Obtain Engineer's approval before proceeding further.

C. The application and incorporation of soil conditioner into individual tree and palm beds may be delayed until after the plant has been placed, so long as the finish soil level is 2" below the top of the root ball and 4" below adjacent turf, pavement or curbs.

D. After the Engineer has approved the application of soil conditioner, mix soil conditioner into the top 9" of topsoil to achieve a uniform mixture of 1/4 soil

conditioner and ¾ topsoil to a depth of 12". In areas free of tree surface roots, use a rototiller to mix soil amendments into existing soil. In areas with surface roots, mix soil amendments into existing soil by hand.

E. Add or remove soil mix necessary to remove ridges and fill depressions so that the soil mix layer at the edge of the plant beds is 4" below adjacent turf, pavement, or curbs. Rake to a smooth, even surface with a loose, uniformly fine texture.

F. If the soil is very dry before planting, water soil sufficiently to moisten the prepared areas. Do not create a muddy soil condition.

3.10 EXCAVATION OF TREE OR PALM PLANTING PITS: Excavate pit with a surface diameter 2 feet larger than the diameter of the root ball and with a depth that will leave top of the root ball 2" above the soil mix layer. If planting date palms, excavate the pit 12" deeper to allow for a layer of yellow sand below the root ball.

3.11 PLANTING

A. General

1. Keep container grown stock in containers until planting time. Pick up plants by ball or container, not by stems or trunks.
2. Perform work in accordance with sound horticultural practice in North Florida.

B. Planting Trees

1. Root Ball Correction Before Planting

a. Container Grown Trees:

1) Remove container before planting. If the first root emerging from the trunk is not visible on the root ball surface, then remove the upper soil layer until the upper structural root is exposed. Remove secondary roots growing over the structural roots.
2) Shave off the outside 1" to 2" layer of roots from the top, sides and bottom of the root ball to remove all circling, descending, and matted root segments not growing radial to the trunk.

b. B&B Trees:

1) If the first root emerging from the trunk is not visible on the root ball surface, then remove the upper soil layer until the upper

structural root is exposed. Remove secondary roots growing over the structural root and the ~~root collar~~trunk flare.

2) Remove all plastic shrink-wrap, straps, and twine from the trunk and the root ball. Before planting, remove roots growing through the burlap and up, down or around the root ball. Also remove the burlap and wire cage from the top of the root ball and the top one or two bands of the wire basket down the sides of the root ball after the tree is properly placed in the pit. Do not bury synthetic fabric in the planting pit.

2. Set the tree plumb in the center of the pit and orient for best appearance.
3. Adjust the depth of the pit so that the top of the root ball is 2" above the soil mix layer.
4. Backfill tree pit with soil mix excavated from the pit. Backfill in 12-inch layers until the soil is 2" below the top of the root ball. Water in and compact each soil layer to eliminate voids. Apply at least 5 gallons of water per inch of trunk caliper during planting and backfilling.

C. Planting Palms

1. Do not free-fall, drag, roll or abuse palms or put a strain on the crown (bud area) at any time. Use a protective device around the trunk of the tree while lifting and relocating. Do not injure the bud, or scar or skin the trunk in any way.
2. For date palms only, place a compacted 12" layer of yellow yard sand in the bottom of the palm pit before planting the palm.
3. Set all palms plumb in the center of the pit and orient for best appearance. If the root ball is B&B, remove twine, shrink-wrap, burlap and wire cage as described for B&B trees. Adjust the depth of the pit so that the top of the root ball is 2" above the soil mix layer.
4. Where underground utilities interfere with the root ball, clear utilities by carefully notching the root ball around the utilities, not by raising the root ball above the finish grade.
5. If the first root emerging from the trunk is not visible on the root ball surface, carefully remove soil from the top of the root ball next to the trunk until the uppermost root is exposed or within 2" of the root ball surface. Pull away soil from the rest of the root ball surface down to the same point. Cut away exposed circling roots.
6. After the palm is set, backfill with soil mix excavated from the pit. Backfill pit with yard sand if the palm tree is a date palm. Backfill soil in 12" layers until the soil is level with adjacent soil mix. Water in and compact each layer to eliminate voids. Apply at least 5 gallons of water per inch of trunk caliper during planting and backfilling.

7. Contain water applied to the root ball with a 3-4” high temporary earthen dam immediately around the edge of the root ball.
8. After planting, remove excess soil and rake plant bed to a smooth even surface conforming to required soil grade, and so that the soil mix level at the edge of the plant bed is 4” below adjacent turf, pavement, or curbs.
9. Place a 3-4” high immediately apply at least 2" of water throughout each bed. If a temporary dam is desired around the edge of the root ball to help contain the water, then construct the dam with the mulch layer; do not use soil for the dam.

D. Planting Shrubs and Groundcovers.

1. Place shrubs and groundcovers where shown and as detailed, using the specified spacing and in accordance with the planting detail shown on the drawings.
2. If the plant is in a container, remove container before planting. If the plant is balled and burlapped, remove twine and burlap completely from the ball before planting. If the plant is in a 1-gallon container or larger, remove container and shave off the outside layer of roots from all sides and bottom of the root ball to remove root defects before planting. Excavate each pit to slightly larger than the root ball area and with slightly less depth than the root ball. Set plant plumb in center of the pit. If the plant has a root ball smaller than a 1-gallon pot, set the plant so that the top 10% of the root ball is above the level of the soil mix layer. If the root ball is equal to 1-gallon or larger, set the plant so that the top 1½” of the ball is above the soil mix layer. Backfill remainder of pit with excavated soil mix and compact to eliminate voids. Keep top of the root-ball free of any soil.
3. Immediately apply at least 2" of water throughout each bed. If a temporary dam is desired around the edge of each root ball to contain the water, then construct the dam with the surrounding soil.

3.12 PLANTING IN MARGINAL WET AREAS

A. If during the excavation of the plant pits water saturated soil is encountered in the very bottom of the pit, stop work and notify the Engineer. The Engineer may approve the planting if the bottom of the root ball can be raised at least 6” above the water table and no higher that two feet above the existing surrounding grades. In multiple plant beds, raise the entire plant bed to the height requested. Otherwise, the plant bed will be deleted or relocated on the site.

B. Fill the pit with existing soil until the entire root ball, when installed, will be above the water table.

C. After the plant is installed, place existing soil against the exposed sides of the root ball to create an earth mound around the root ball with a 4:1 maximum slope from the edge of the root ball to the edge of the bed.

D. Complete planting as specified for plants.

E. The City will pay for the labor and materials to raise the beds above existing grade with additional soil at the negotiated price for soil replacement or by the unit price established in the bid proposal.

3.13 PLANTING ON SLOPES: When planting on a slope, form a level platform by cutting into the slope on the back side of the tree and then using the cut soil as fill on the front side of the tree so that the volume of cut and fill are equal. The level platform for a shrub or groundcover shall be twice the diameter of the root ball; for a tree or palm, equal to the diameter of the root ball plus 1 foot.

3.14 FINISHING PLANT BEDS

A. After planting, remove excess soil and rake plant beds to a smooth even surface after plants are installed so that the soil mix grade at the edge of the plant beds is 4" below adjacent turf, pavement, or curbs to allow for a 3" layer of mulch, leaving 1" between the top of the mulch and the top of the adjacent turf, pavement or curb. Keep top of each root ball free of any soil.

B. Immediately apply at least 2" of water throughout each bed. DO NOT USE SOIL DAMS around the edge of the root ball. If a temporary dam is desired around the edge of the root ball to help contain the water, then form the dam with the thicker layer of surface mulch.

3.15 WATERING

A. General: Water plants sufficiently to keep roots moist, but not saturated and as needed for the healthy growth and to prevent wilting. (The Agriculture Extension Service recommends watering daily for at least one month after installation during the growing season when there is no rain). Following a rainfall, delay watering until all free moisture (gravitational water) has drained from the soil.

B. After initial watering, where plants are not covered by an automatic irrigation system, provide temporary watering using water bags and/or a temporary irrigation system that will provide to each plant during each watering cycle.

C. If water bags are used to water trees and palms, place water bag around the trunk and fill with water in accordance with manufacturer's instructions to provide a slow water drip of at least 4 hours. Fill water bag with each subsequent watering.

D. If a temporary irrigation system is used, connect the system to a water truck or other water source and pump water until the specified volume of water in the tables below is delivered to each plant through emitters. Apply at a rate that will allow the water to soak into the root ball without runoff.

E. Maintain each water bag or temporary irrigation system in working condition throughout the installation and maintenance period and until final acceptance. Immediately repair or replace each water bag or temporary irrigation system that is damaged, stolen or malfunctioning.

3.16 PRUNING

A. Prune plants in accordance with the ANSI Z60.1 and ANSI A300 standards ~~horticulture practice and~~ no less than once every six (6) months to remove sprouts and dead/injured/diseased wood, and to establish a single (unless specified as multi-stemmed) leader with subordinated branches. Use a Natural pruning system unless otherwise specified. ~~. Prune to remove suckers, dead, injured or diseased wood, and to achieve a uniform shape natural to each species.~~ Required plant sizes are after pruning. Replace excessively pruned or malformed plants. Do not cut tree leaders except for tip pruning.

B. Prune crape myrtles, ligustrums, and other multi-trunked trees to remove suckers or water sprouts growing from the root ball and from the lower portion of the main trunks. Also remove small, twiggy growth that has developed underneath and within the tree canopy.

C. Crape myrtles: Cut back the tips of all stems approximately one foot to promote branching and blooming. Maintain upright branching character by removing branches that are drooping below a 30-degree angle from vertical. Extend pruning to create a very upright branching tree with a full, gently rounded crown.

3.17 TREE AND PALM ACHORING

A. General: Anchor trees and palms to maintain them in a vertical alignment.

B. Trees: Anchor tree root balls as detailed using "Anchor System 1 or 2."

C. Anchor palm root balls, except date palms, as detailed using Anchor System 1 or 2". Anchor date palms as detailed "Anchor System 2".

3.18 MULCHING: Apply sufficient mulch to maintain 3 inches of mulch in all beds. Rake to neat, finished appearance. Top of mulch to be 1" below adjacent top of pavement, curb or lawn. Pull mulch 8” away from each tree and palm trunk and 3” away from the main stem of smaller plants.

3.19 FERTILIZING

A. Trees: Fertilize as needed in accordance with the ANSI A300 standard and product label. Forward a written record of the date, fertilizer applied, and rate of application to the project manager within five business days of application. ~~Immediately after planting, spread 1 cup of tree fertilizer evenly over the root ball and 1’ beyond in accordance with manufacturer’s instructions~~.

B. Palms: Immediately after planting, spread 1 ½ pounds of palm fertilizer evenly in a 2’ band around the root ball in accordance with manufacturer’s instructions.

C. Multiple Plant Beds: Apply fertilizer at a rate to achieve 1 lb. of nitrogen per 1000 square feet of bed area.

3.20 APPLICATION OF PRE-EMERGENT HERBICIDE: Rake mulch smooth and apply pre-emergent herbicide throughout all beds. Apply herbicide at the recommended manufacturer’s rates and in strict accordance with the label instructions.

3.21 SUBSTANTIAL COMPLETION INSPECTION AND ACCEPTANCE

A. Inspection shall be made by the Engineer within ten days of written notification from the Contractor that installation is complete.

B. Plants shall be acceptable if in “healthy, vigorous condition” and are in compliance with both the specific specifications for each named plant and the general specifications for all plants.

C. Replace rejected work within 14 days of notification and continue specified maintenance until re-inspected and found to be acceptable. Remove rejected plants and materials promptly from project site.

3.22 MAINTENANCE PERIOD

A. See Specification Section 147-LANDSCAPE MAINTENANCE for specific maintenance requirements.

B. Begin maintenance of landscape work immediately after each area is planted and continue until Initial Acceptance, through the specified maintenance period, and until Final Acceptance of the landscaping.

3.23 LANDSCAPE WARRANTY IF LANDSCAPE MAINTENANCE IS INCLUDED DURING THE WARRANTY PERIOD

A. Warranty that all plants will remain in "healthy, vigorous condition" and meet specifications during the Warranty period from the date of of Substantial Completion until the date of Final Acceptance.

B. If the Final Inspection occurs in the dormant season, then the warranty of deciduous plants shall be extended until the deciduous plants are in full green leaf after dormancy and can be inspected and approved by the Engineer.

3.24 MONTORING OF LANDSCAPE MAINTENANCE BY OTHERS DURING THE WARRANTY PERIOD

A. If landscape maintenance during the Warranty period is not included in the bid price but is provided by the City, the Contractor's warranty remains in effect, so long as the City maintains the plants in a healthy, vigorous condition.

B. To ensure that the plants remain in "healthy, vigorous condition," the Contractor must monitor the City's landscape maintenance during the Warranty period. Make at least 1 visit per month to observe the Owner's maintenance. If maintenance, including watering, is not sufficient to maintain plants in a healthy condition, immediately notify the Engineer in writing describing the problems with the maintenance and the corrective action required so that the Engineer can take corrective action.

C. If the Contractor fails to visit the site and notify the Engineer, in writing, of the maintenance deficiencies, then the lack of maintenance cannot be used by the Contractor as grounds for voiding or modifying the provisions of the warranty.

D. If the City discovers conditions during the warranty period that are not in conformance with the landscape specifications, the Contractor shall take corrective action upon the Engineer's notification.

3.25 FINAL INSPECTION AND ACCEPTANCE

A. When maintenance work is complete, submit written notification to the Engineer. The Engineer shall conduct a final inspection within 10 days after receipt of the Contractor's notification.

B. Plants: Plants shall be acceptable if they are in “healthy, vigorous condition” and remain in compliance with both the specific specifications for each plant named and the general specifications for all plants.

C. Plant Beds: Plant beds shall be acceptable if the plant beds are free of weeds, are well drained and are covered by a uniform layer of mulch of the specified thickness.

D. Replace rejected work with 14 days of notification. Continue landscape maintenance until work is re-inspected and found acceptable.

3.26 MEASUREMENT AND PAYMENT: Measurement and payment of landscaping, completed and accepted, is established in the proposal either as a lump sum or on a unit price basis. The price includes all work specified in this section including materials, soil preparation, planting, watering, pruning, staking, mulching and landscape maintenance until the Initial Acceptance. The price also includes the cost of maintenance during the warrant period, if included in the scope of work.

3.27 REPLACEMENTS AND CONDITIONS

A. The specified plant warranty, including the maintenance, inspection, and acceptance provisions, shall apply to replacement plants. All plants that do not meet specifications or do not reflect a healthy, vigorous condition as specified under Section 144.11 Plants shall be rejected and replaced immediately. All plant material shall meet this criterion at the end of the maintenance period.

B. Replacements shall comply with specified requirements for new plants.

C. After the Substantial Completion acceptance date, the Contractor will not be responsible for damage to work resulting from: neglect by Owner; damage by others; abnormal weather conditions such as floods, excessive winds, severe freezing or abnormal rains; or activities by others beyond the Contractor's control.

END OF SECTION 601

Design Requirements for Planting Trees in Urbanized Sites

Because of the unique requirements for successful planting in more urbanized areas, a report for each planting site with the following requirements shall be submitted to the City Arborist for evaluation. Ultimately, the design should facilitate tree establishment and growth to maturity as a healthy tree and – in the case of emergent shade trees - with structures conducive to a low likelihood of failure.

1.) The available soil volume (area X 3 ft depth (shade tree) or 2 ft depth (ornamental tree) should match the ultimate size of the proposed tree:

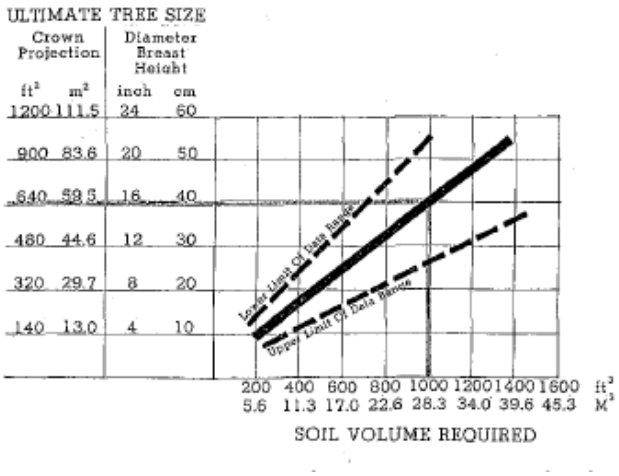


Figure 1. Soil volume for trees of different diameters (from Urban, J. 1992).

The equation for this line where x is the soil volume and y is the crown projection is:

$$y = \frac{1}{6}x + \frac{100}{3}$$

or:

$$x = 6(y - \frac{100}{3})$$

Therefore, if either the available soil volume or the ultimate tree size is known, the other may be calculated.

If the available soil volume will be established through the use of load transfer systems (e.g. Silva Cells) or structural soils (e.g. CU Structural Soil) paired with permeable surfacing, provide a detailed proposal.

2.) The surface cutout should be adequate for the ultimate size of the proposed tree, and installations at surface (e.g. grates, permeable asphalt and pavers, etc.) should either be absent or accompanied by a maintenance plan with a funding source:

Table 1. Minimum cutout area for trees of different sizes (UF IFAS).

Tree Size	Cutout Area
Large maturing trees	8 x 8 feet
Medium sized trees	6 x 6 feet
Small stature trees	4 x 4 feet

3.) If soils are retained (with or without amendment), the City Arborist may require that they be analyzed by coring at least once at each potential site with the results reported to the City Arborist. The product of the analysis should be consistent with expectations for tree success. If it is not, a specification for soil amendment and/or replacement should be proposed. Soil analysis for each planting site to include:

a.) Picture of vertically-cored soil column from current established grade to proposed planting depth.
b.) Description of soil structure, including method of analysis:
    i. Texture (e.g. native/non-native, sand/silt/clay %)
    ii. Density/extent of compaction
    iii. Drainage
c.) Description of soil smell – sweet or otherwise (gaseous/sulfur, anaerobic, etc.)

Soil amendment and/or replacement specifications should include:

a.) Approximately 1-10% below-surface organic content.
b.) Because unamended/unengineered soils that are not *in situ* have less macropore and micropore structure than preserved soils, the proposal of a mechanism to provide adequate gas exchange between the air and roots may be required.
c.) 3 inches depth of mulch installed at the surface for the entire cutout immediately after tree installation, 6 inches removed horizontally from the trunk.
d.) Proposals in line with the City Land Development Procedures Manual specifications are a good starting point.

4.) Provide an irrigation plan consistent with providing available water to the tree at or below field capacity and above the wilt point over the course of the warranty period.

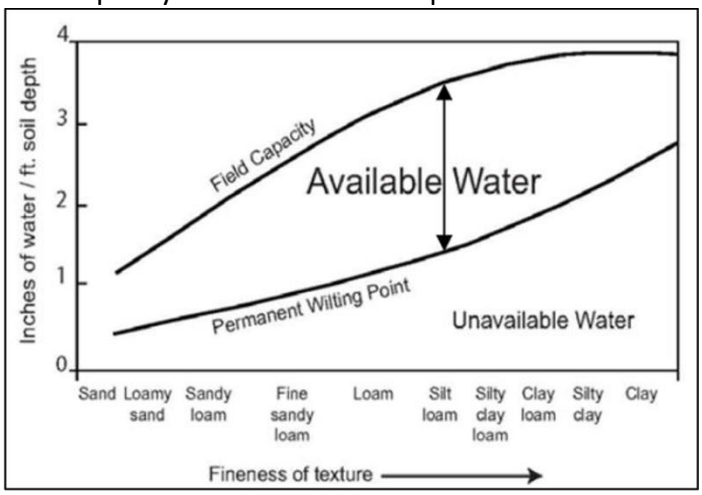
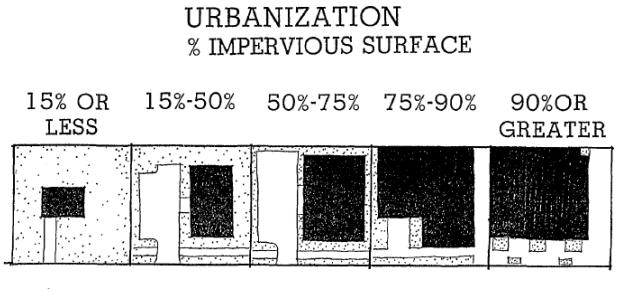


Figure 1: Diagram showing the available water for different textures of soil (USDA, 2008)

5.) Note the percent impervious surface:



6.) Note the current and proposed locations of any utilities.

7.) Note the presence of buildings adjacent to planting site: none, 1-2 stories, >2 stories high.

8.) Describe these characteristics of water features; proximity, proportion salt/fresh, size of water body, extent of ephemerality.

9.) The tree should be a species (and, in some cases, cultivar) that is approved for planting by the Tree Commission.

10.) The tree should have characteristics compatible with the planting site.

11.) Describe the maintenance plan in terms of pre- and post-warranty feasibility.

12.) Include typical City tree and soil preservation details, noting any modifications. Detail to include:

a.) Statement that “Tree planted with root flare visible at or slightly above grade.”

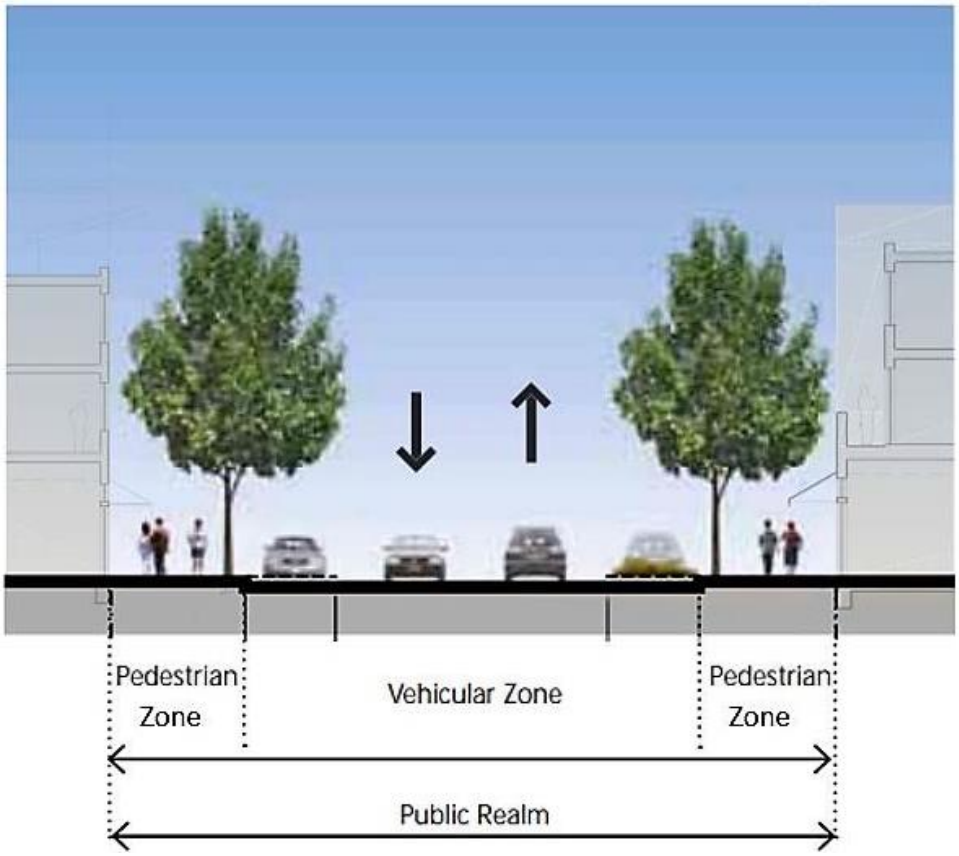
b.) If soil is preserved or amended rather than replaced, include one “Keep out – Soil preservation area” sign per TPZ fence post.
c.) Fencing should be 6-foot-tall chainlink on minimum 10 foot center posts. If the project is smaller (e.g. 500 square foot TPZ area) and in an urban environment with greater impervious surface, the posts should be on above-ground footing. If the project is larger (five or more acres) and with less impervious surface, the posts may be driven into the ground a minimum of two feet depth, a minimum of the CRZ and associated silt fencing away from the trunk of the tree. The goal is to minimize the impact upon tree roots of fence posts that are driven into the ground.
d.) Statement that “TPZ fencing shall be established prior to project pre-construction meeting and shall not be moved without prior written consent of City project tree manager.”

Sec. 656.361.6.3. Public Realm Regulations.

The beauty and livability of a city depends greatly on the design of its streets. The character and quality of the space between the curb and the face of a building substantially impacts the way people walking in the city feel about it. Creating comfort for the pedestrian is an important way to generate positive economic activity on the street. Public sidewalks should provide a direct and continuous pedestrian network that connects blocks and buildings to each other with a clear, unobstructed pedestrian travelway that is designed to accommodate the needs of a broad range of users, including the elderly, those with disabilities, and young children. Sidewalks should be richly appointed with improvements and facilities that enhance the pedestrian experience but should avoid clutter and congestion.

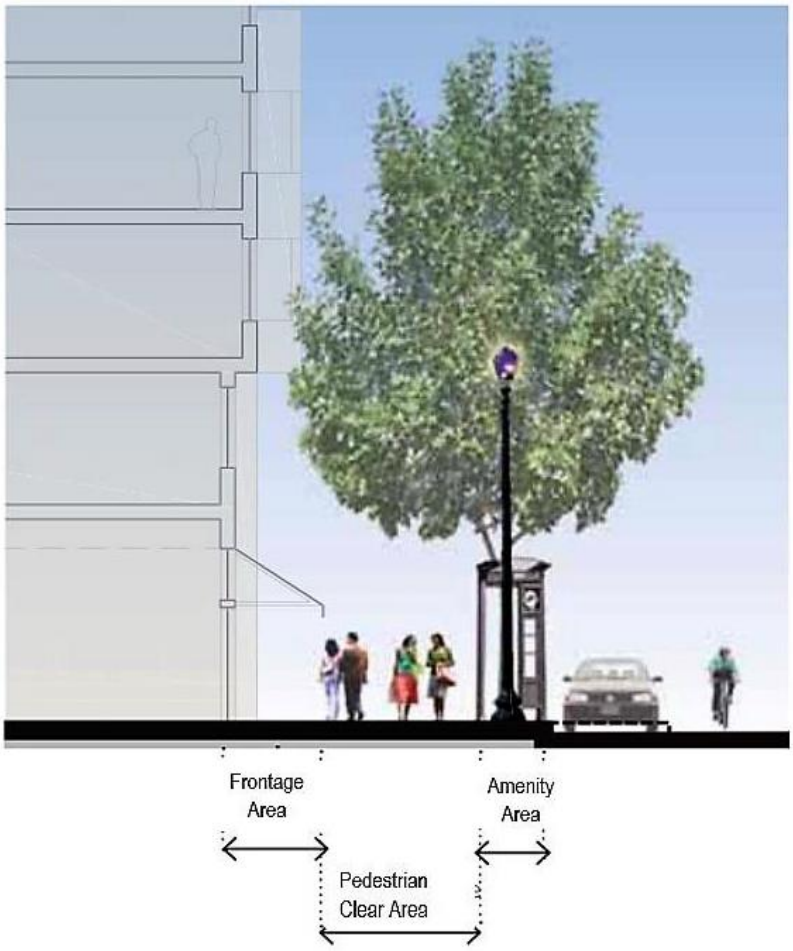
A. *Functional Zones and Areas.* The Public Realm includes the Pedestrian Zone and the Vehicular Zone, as illustrated in Figure 6.3.A, below.

Figure 6.3.A Public Realm



The Pedestrian Zone Requirements are intended to promote a more walkable downtown by improving pedestrian comfort, safety and convenience. The Pedestrian Zone is further divided into three functional areas. The Pedestrian Clear Area is the middle of the pedestrian zone and primarily accommodates pedestrian circulation. The Amenity Area generally is adjacent to the street and accommodates public facilities such as street trees, ground cover, permeable paving to protect trees from compaction but also allow water to penetrate to the roots, street furniture, trash cans, kiosks, lights, utility poles, and parking meters, signs, and other obstructions to pedestrian travel. These areas are typically distinguished by a change in materials, from hard materials to greenery, though in areas of high pedestrian traffic the amenity area may include less planting and more paving. The Frontage Area is adjacent to building frontages and serves as a transition area where pedestrians do not generally pass as it is directly adjacent to building features. The Pedestrian Zone functional areas are illustrated in Figure 6.3.A-2, below.

Illustration 6.3.A-2



B. *Pedestrian Zone (Sidewalk).*

1. *Purpose and Intent.* The Pedestrian Zone serves several functions - circulation facility, social space, and amenity area - and must accommodate numerous features and facilities to support these functions. The widths of the Pedestrian Zone areas should vary in response to context, but Pedestrian Zone width should be distributed amongst the three areas according to the following priorities: pedestrian (highest), amenity (middle), frontage (lowest, except when activated as a sidewalk cafe).

2. *Requirements for the Pedestrian Clear Area.*

(a) The Pedestrian Clear Area shall be a minimum of five feet in width in all areas regardless of right-of-way width. Where adequate right-of-way exists beyond the edge of the Vehicular Zone, the Pedestrian Clear Area shall be expanded to at least eight feet (six feet adjacent to permitted sidewalk cafes) prior to expanding the adjacent Amenity Area beyond the four-foot minimum or expanding the Frontage Area. When the right-of-way allows for a greater Pedestrian Zone width, the additional width may be allocated to Amenity Area, Frontage Area or Pedestrian Clear area as desired.

(b) The Pedestrian Clear Area shall maintain a minimum vertical height clearance of eight feet, clear of overhanging tree limbs, protruding fixtures such as awnings, or other horizontal obstruction.

(c) Transitions in width of the pedestrian clear areas shall be signaled by a transitional element.

(d) Paving. Paving shall be installed in the streetscape. The type of paving, design and paving materials shall comply with the standards as set forth in the Downtown Jacksonville Streetscape Standards. Paving may be pervious in certain areas in order to accommodate street trees, as approved by a City Landscape Architect or Arborist.

3. *Requirements for the Frontage Area.*

(a) The Frontage Area shall be a minimum of two feet in width in order to accommodate standpipes, building protrusions and ledges, etc. as well as merchandise displays, planters, art, and portable signage (e.g., menu stand). This zone may expand as desired to accommodate permitted sidewalk café and other similar uses, but only after a minimum six-foot Pedestrian Clear area has been achieved in the case of permitted sidewalk cafes, or eight-foot Pedestrian Clear area has been achieved for any other use within the Frontage Area, and a minimum four-foot Amenity Area has been provided.

(b) Sidewalk cafes (See Chapter 250, Part 8 (Downtown Sidewalk Cafes), Ordinance Code) are encouraged and shall generally be located in the Frontage Area. However, in certain situations, sidewalk cafes and other commercial activities may be allowed to occupy the Amenity Area rather than the Frontage Area or where extra wide sidewalks occur, in both the Frontage and Amenity Areas.

(c) Sidewalk cafes that have more formal dining facilities (i.e., offer waiter service to their tables) or more than a single row of tables shall provide a decorative element, such as a railing, rope divider, etc., that delineates the café from the Pedestrian Clear Area.

4. *Requirements for the Amenity Area.*

(a) The Amenity Area shall generally have a depth, as measured from the back of curb, of **four feet minimum**. Once the eight-foot Pedestrian Clear Area width has been accommodated, and a minimum Frontage Area has been provided, the Amenity Area may be expanded as desired, to accommodate additional trees, shade trees, street furniture and the like. Amenity Area width shall conform to adjacent properties or transitions in width from adjacent Amenity Areas shall be signaled by a transitional element.

(b) In locations where right-of-way is constrained, in order to prioritize the Pedestrian Clear Area, the requirements for the Amenity Area may be reduced, undulating, or satisfied by bump-outs between on-street parking spaces provided that all required streetlights, traffic signage, trees, street furniture and other amenities are accommodated within such modified Amenity Area(s) and do not interfere with the Pedestrian Clear Area. Also, pervious paving may be allowed in both the Amenity area and the Pedestrian Clear Area to accommodate tree growth and health.

(c) Vertical fixtures, furnishings, and similar elements within the Amenity Area shall be setback at least two feet from the face of the curb to avoid conflict with on-street parking in areas where on-street parking is allowed. Rights-of-way maintained by the Florida Department of Transportation shall be governed by the standards set by that agency.

(d) Trash receptacles shall be located in the Amenity Area and generally placed near intersections (but beyond 20 feet from the nose of the intersection), near major building entrances, and adjacent to outdoor seating areas.

(e) Each receptacle shall prevent wind and rain from entering the container, and have the option of being anchored to the pavement.

(f) Newspaper racks, if any, shall be consolidated.

(g) Streetlights. The type, number, and spacing of streetlights shall comply with the standards set forth in the Downtown Jacksonville Streetscape Standards and as approved by the City Engineer.

(h) Street Furniture. Street furniture shall be installed in the Amenity Area where appropriate. The type, number and spacing of street furniture shall comply with the standards as set forth in the Downtown Jacksonville Streetscape Standards.

(i) General Criteria for Trees. Trees shall be planted in the streetscape. The type of tree, number of trees, and spacing of trees shall comply with the following standards. To the extent that the Downtown Streetscape Design Guidelines are not inconsistent with these standards, the Guidelines shall be followed.

(1) Trees and palms shall be chosen from the Jacksonville Tree Commission's Approved Tree Planting List;

(2) Single trunk trees shall have a minimum four-inch caliper at the time of planting. The height may vary depending on the species of tree;

(3) Multi-trunked trees shall have a minimum of three trunks and an overall height of 12 feet at the time of planting;

(4) Palms shall have a minimum of 16 feet of clear trunk;

(j) Required Tree to Soil Volume Ratio. Soil volume refers to the cubic feet of soil required for adequate root growth of a tree, generally based upon a three-foot depth. A healthy root system is one of the most critical factors enabling trees to withstand hurricane-force winds. In non-urban settings, the soil volume may be much larger due to the space available, and the lack of underground utilities and other obstructions. In an urban setting, the volumes are necessarily lessened due to the limited amount of space. The following are the minimums necessary for successful tree growth, along with other techniques such as utilization of structural soil, suspended sidewalks, root paths, and planting strips:

(1) Small trees: 300 cubic feet;

(2) Medium trees: 1200 cubic feet; and

(3) Large trees: 1800 cubic feet.

(4) A 25 percent reduction is allowed in the volumes when the soil is shared between trees. See the following link for more information: http://hort.ufl.edu/woody/documents/EP309.pdf.

(k) *Irrigation.* Automatic Irrigation systems shall be installed underground to service all trees and other landscape material, and the irrigation system shall be maintained in operable condition at all times. The type and size of irrigation system shall comply with City's Land Development Regulations. An alternative to automatic irrigation may be used upon approval by a City Landscape Architect or Arborist of another method of providing water and nutrients to the tree and other plant material.

(l) *Inspection.* Inspection of trees planted pursuant to this subsection shall occur six months after planting to ensure all trees are in healthy condition. Trees found to be in a declining condition shall be replaced within 30 days of notice thereof. If replacement is necessary, there shall be a re-inspection six months after replacement and the provisions of this subsection shall apply to the re-inspection.

5. *Transit Shelter Requirements.* Transit shelters shall be installed where appropriate and located within the Amenity Area. The type and design, number, spacing and location of transit shelters shall be approved by the DDRB pursuant to subsection 656.361.7 (Application and Procedure) and comply with the standards set forth in the Downtown Jacksonville Streetscape Standards to

the extent that they are not inconsistent with the standards in this ordinance, and as approved by the City's Engineer, if required. The transit shelter design type shall be chosen from at least three options provided by JTA, whose design shall be in keeping with the historic character of the downtown streetscape furniture and street lights, or as approved by the JTA. Such approval by the City's Engineer, if required, shall occur before final approval of the transit shelter by the DDRB. Any changes to the transit shelter after the DDRB approval by JTA and/or the City's Engineer shall be communicated to the DDRB, and approval granted by the DDRB prior to the City's Engineer approving such changes. The following criteria shall apply:

(a) The permitted transit shelter site, excluding overhangs, shall be no larger than 16 feet long by ten feet high by five feet wide, and no larger than 80 square feet in size.

(b) The overhang shall have a minimum clearance of eight feet and be set back from the back of curb a minimum of two feet.

(c) When a shelter is located on the street side of a sidewalk, there shall be a minimum four-foot clearance for pedestrian traffic between the front of the shelter and the nearest back of curb.

(d) Transit shelters must be at least six feet from any driveway.

(e) Transit shelters shall only number one per side of street per block, except the bus rapid transit stations as shown on JTA's Jacksonville BRT Phase I map, a copy which is on file with the DIA. The DDRB may approve an exception to allow more than one transit shelter per side of the street per block when it is requested by the transportation authority due to high transit ridership, safety concerns and/or it is in the best interest of the riders.

(f) Transit shelters must be a minimum of ten feet from an intersection or crosswalk.

(g) Transit shelters must be a minimum of six feet from any building entrance or exit.

(h) Transit shelters may not obstruct any view of traffic or roadway signage.

(i) Transit shelters may be illuminated with lighting that is interior to the structure and shall not interfere with the ability of vehicular users of the road to read traffic signs or see traffic signals.

(j) Transit shelters shall include, at a minimum, one trash can per shelter and the trash can shall not obstruct the minimum clearance as established in subsection (c) of this Section.

(k) Transit shelters and associated pull-outs that disrupt more than 50 percent of any one side of the street, per block, shall meet the Downtown Streetscape Design Standards for the side of the street, per block, that is disrupted.

(l) Existing transit shelters shall not be required to meet these standards until replaced with a new transit shelter, which shall meet the requirements of this subsection.

(m) Any signage associated with transit shelters and associated areas shall be subject to Chapter 656, Part 13, Subpart B.

(n) In the event that any portion of this Section, including any exception contained herein, is declared invalid, unenforceable, unconstitutional or void, or is permanently enjoined, or if the existence of any provision of this Section would result in any other portion of this Chapter or Chapter 326 or Article 23 of the Charter being held to be invalid, unenforceable, unconstitutional or void, and the court does not sever such invalid portion of this Section, then the invalid portion of this Section is repealed and invalid and thereafter no signs of the type included within the exemption shall be erected without compliance with the remainder of this Chapter and this Ordinance Code. It is the specific intent that the invalidity of any portion of this Section shall not affect any other section, subsection,

paragraph, subparagraph, sentence, phrase, clause or word of this Chapter, Chapter 326, Article 23 of the Charter, or this Ordinance Code.

(o) *Streetscape maintenance agreement.* At the time of issuance of a certificate of occupancy, all property owners constructing streetscapes shall be required to execute a maintenance agreement or other similar agreement, in a form acceptable to the City, in which the property owner agrees to (a) maintain and repair all elements of the streetscape when needed, unless the City determines it will maintain and repair the streetscape improvements, and (b) comply with the provisions of Part 5 of Chapter 518.

6. *Deviations.* Deviations from the following requirements may be allowed by the DDRB only if the decision is based on competent substantial evidence that deviating from the requirement meets all of the General Deviation Criteria contained in subsection 656.361.8.B, and in addition meets all of the criteria listed for each requirement below:

(a) A Deviation from the width requirements of the Areas will only be allowed only if such use and facilities enhance the overall quality of the Public Realm and do not impede pedestrian traffic or conflict with access to on-street parking.

C. *Pedestrian Protection from the Elements.*

1. *Purpose and intent:* In the urban environment and our climate, it is essential to provide pedestrians with protection from sun and rain. Building designs should incorporate features that provide pedestrian shelter from the elements to the greatest extent possible. Protection may come in the form of structures such as overhangs, canopies and awnings, or from shade trees on-site or in the Streetscape.

Illustration 6.3.C Awnings

Awnings highlight building entrances and contribute to pedestrian comfort.

2. *Requirements for shade.*

(a) There shall be shade provided for at least 40 percent of the Public Realm Pedestrian Zone associated with each new development, such percentage coverage to be measured from

the right-of-way line to two feet interior of the face of the curb. Existing street trees may be used in this calculation.

(b) If shade trees are provided, they must meet the definition, pervious surface requirement, and pruning restrictions as contained in Chapter 656 (Zoning Code) Part 12 (Landscape Code), and must reach the percentage shade coverage requirement within 5 years.

(c) If Crape Myrtles are used, hat-racking is prohibited.

(d) In the absence of existing street trees that provide shade in the public right-of-way, the adjacent development shall:

(1) Incorporate building projections into the right-of-way, roof overhangs, awnings and similar protections from rain, located between eight and 20 feet above grade to provide a minimum 40 percent shade along the frontage; or

(2) The development shall install trees within the right-of-way to produce 40 percent shade within five years of the issuance of the Certificate of Occupancy. The developer shall consult with the City Arborist for the appropriate tree species for the location and provide the appropriate planting area and soil amendments and structure; or

(3) A combination of (1) and (2), above.

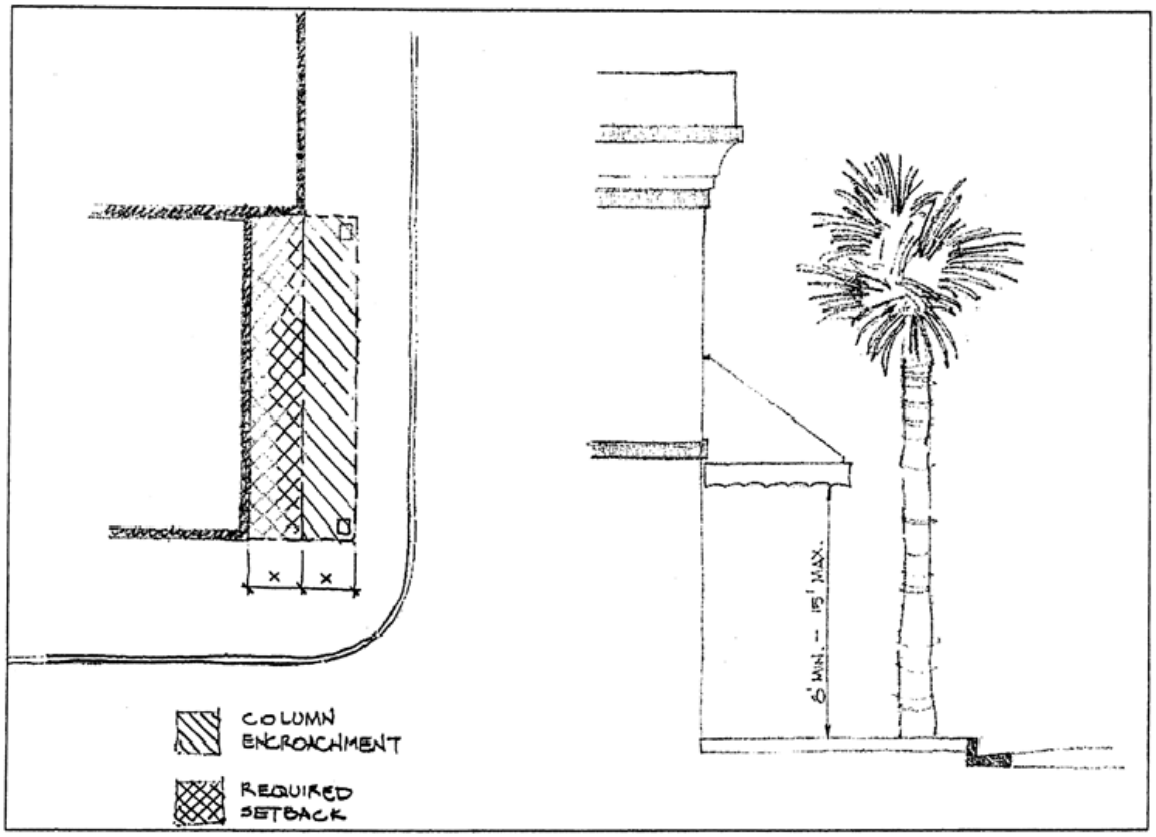
3. *Requirements for Protection from the elements.*

(a) Protection from the elements, which may include trees or structural features shall be incorporated in new development and in any major renovation of an existing building that alters the exterior of existing building.

(b) Awnings, arcades, recessed entry doors, or other structural elements that provide shade from the sun and protection from the rain shall be provided over all doors.

(c) In order to accomplish protection from the elements, portions of a building or structure such as: awnings, balconies, structural elements, overhangs and cantilevered shelters, may be allowed to extend over or into the public right-of-way to within two feet of the curb, subject to the approval of the Director of the Public Works Department, as shown in Figure 6.3.C, below, and subject to compliance with the following:

Figure 6.3.C



(1) The minimum vertical clearance between the established grade of the public right-of-way and the underside of the encroaching structure is at least eight feet.

(2) Supporting columns will be permitted within the Pedestrian Zone when the grade level floor of the structure is set back a distance equal to or greater than the Pedestrian Zone area lost to the supporting columns, as shown in Figure 6.3.C above. This requirement shall not apply in the case of an existing building where an addition or alteration may result in the necessity to locate supporting columns within the Pedestrian Zone.

(3) A Pedestrian Zone consistent with the Public Realm regulations is provided.

(4) Structures built over the public right-of-way shall not interfere with any element of the streetscape including, but not limited to, lighting, landscaping, and pedestrian circulation.

(5) The structure extension has been reviewed, with due consideration to public right-of-way width, above ground and underground utilities (including the need for overhead crane access to underground transformers), pedestrian views or visibility, and adjacent structures.

(d) Buildings or structures may provide awnings, arcades or other structural elements that provide shade from the sun and protection from rain, etc., over windows and other transparent elements, subject to the requirements of this Section.

4. *Deviations allowed by the DDRB:* Deviations may be allowed by the DDRB if the decision is based on competent substantial evidence that the request meets the General Deviation Criteria contained in subsection 656.361.8.B, and in addition that:

   (a) Regarding Shade: If it can be shown that due to the height and orientation of the building that shade will be provided on the sidewalk between noon and 6:00 p.m. without the addition of trees or other shade features;

   (b) Regarding Protection from the rain: Entrance porticos, awnings or similar features are architecturally incompatible, and an alternate compatible accommodation is proposed.

TREE COMMISSION
APPROVED TREE PLANTING LIST

Tree	Right of Way	Parks	DCPS[14]	Expected Full Grown Height	Expected Full Grown Spread	[2] Foliage	[3] Light Required	[4] Soil Drainage	[5] Drought Tolerance	[6] Growth Rate	Soil Tolerance (pH)	[13] IFAS FL Friendly
SMALL TREES												
Callistemons citrinus Red Bottlebrush	Y	Y	N	10-15'	10-15'	E'GRN	FS	WD, OW	HIGH	MOD	(4.5-8.0)	Y
Carpinus caroliniana American Hornbeam	Y	Y	N	20-30'	20-30"	DECID	FS, PS	WD	HIGH	SLOW	(4.2-7.6)	Y
Cercis canadensis Eastern Redbud	Y	Y	N	20-30'	20-35"	DECID	FS, PS	WD	HIGH	FAST	(4.2-7.6)	Y
Chionanthus retusus Chinese Fringetree	Y	Y	N	15-20'	10-15'	DECID	FS, PS	WD, OW	MOD	SLOW	(5.5-6.5)	Y
Chionanthus virginicus Fringe Tree	Y	Y	N	12-20'	10-15'	DECID	FS, PS, SH	WD, OW	MOD	SLOW	(5.5-6.5)	Y
Crataegus spp. Hawthorn	Y	Y	Y	20-25'	10-20'	DECID	FS, PS	WD	HIGH	MOD	(4.8-7.5)	Y
Ilex x koehneana 'Wirt L. Winn' Wirt Winn Holly	Y	Y	N	15-25'	10-15'	E'GRN	FS, PS	WD, OW	MOD	SLOW	(5.0-8.0)	Y
Ilex vomitoria Yaupon Holly	Y	Y	Y	15-25'	15-25'	E'GRN	FS, PS, SH	WD, OW	HIGH	SLOW	(4.5- 8.2)	Y
Lagerstroemia indica var. Natchez, Muskogee, or Tuskegee) Crape Myrtle (Standard or Mult-trunk)	Y	Y	Y	10-30'	15-25'	DECID	FS	WD	HIGH	MOD	(5.0-7.5)	Y
Ligustrum japonicum Wax-Leaf Ligustrum	Y	Y	Y	8-12'	15-25'	E'GRN	FS, PS	WD	MOD	MOD	(5.5-7.5)	Y
Magnolia grandiflora 'Little Gem' Little Gem Magnolia	Y	Y	N	25-35'	8-12'	E'GRN	FS, PS, SH	WD, OW, W	MOD	SLOW	(4.5-7.5)	Y
Magnolia macrophylla ssp. Ashei Ashe Magnolia	Y	Y	N	10-15'	8-10'	DECID	PS, SH	OW	MOD	MOD	(4.8-7.5)	Y
Myrica cerifiera Wax Myrtle	Y	Y	Y	15-25'	20-25'	E'GRN	FS, PS, SH	WD, OW	HIGH	FAST	(5.5 -8.2)	Y
Prunus umbellata Flatwoods Plum	Y	Y	N	12-20'	12-20"	DECID	FS, PS	WD	MOD	MOD	(4.8-7.5)	Y
Taxus floridana Florida Yew	Y	Y	N	10-25'	15-25'	E'GRN	PS, SH	WD, OW	HIGH	SLOW	(5-6.5)	Y
Viburnum obovatum Walters Viburnum	Y	Y	N	8-25'	6-10'	E'GRN	FS, SH	WD, OW	HIGH	MOD	(5.0-7.5)	Y

TREE COMMISSION
APPROVED TREE PLANTING LIST

Tree	Right of Way	Parks	DCPS[14]	Expected Full Grown Height	Expected Full Grown Spread	[2] Foliage	[3] Light Required	[4] Soil Drainage	[5] Drought Tolerance	[6] Growth Rate	Soil Tolerance (pH)	[13] IFAS FL Friendly
Vitex angus-castus Chaste Tree	Y	Y	N	10-15'	15-20'	DECID	FS, PS	WD, OW	HIGH	FAST	(4.5-8.5)	Y
MEDIUM TREES												
Betula nigra River Birch	Y	Y	Y	40-50'	25-35'	DECID	FS, PS	OW, W	LOW	FAST	(4.0-6.5)	Y
Elaeocarpus decipiens Japanese Blueberry Tree	Y	Y	N	30-40'	30-40'	E'GRN	FS, PS	WD, OW	MOD	MOD	(4.0-7.5)	Y
Eriobotrya japonica Loquat	Y	Y	N	20 - 30'	30-40'	DECID	FS, PS	WD	MOD	SLOW	(4.8-7.5)	Y
Ilex attenuata 'Eagleston' Eagleston Holly	Y	Y	Y	18-25'	6-10'	E'GRN	FS, PS	WD, OW	MOD	MOD	(4.0-7.5)	Y
Ilex attenuata 'East Palatka' East Palatka Holly	Y	Y	Y	30-45'	10-15'	E'GRN	FS, PS	WD, OW	MOD	MOD	(4.0-7.5)	Y
Ilex cassine Dahoon Holly	Y	Y	Y	20-30'	8-12'	E'GRN	FS, PS	OW, W	MOD	SLOW	(3.5-6.5)	Y
Juniperus silicicola Southern Red Cedar	Y	Y	N	30-45'	20-30'	E'GRN	FS, PS	WD	HIGH	SLOW	(5.5-8.0)	Y
Magnolia virginiana Sweetbay Magnolia	Y	Y	N	40 - 50'	15-20'	DECID	FS, PS	WD, OW	MOD	MOD	(4.8-7.5)	Y
Nyssa Ogeechee Ogeechee Tupelo	Y	Y	N	35-45'	25-35'	DECID	FS, PS	WD, OW, W	HIGH	MOD	(4.0-7.0)	Y
Olea Europaea Olive Tree	Y	Y	N	25-30'	15-20'	E'GRN	FS	WD	HIGH	MOD	(4.0-6.0)	Y
Ostrya virginiana American Hophornbeam	Y	Y	N	30 – 40'	25-30'	DECID	FS, PS, SH	WD	MOD	MOD	(3.5-6.5)	Y
Pinus clausa Sand Pine	N	Y	N	25 – 40'	15-25'	E'GRN	FS, PS	WD	HIGH	SLOW	(4.8-7.5)	Y
Ulmus alata Winged Elm	Y	Y	N	45-70'	30-40'	DECID	FS, PS	WD, OW	LOW	MOD	(5.0-8.0)	Y
Ulmus parvifolia 'Bosque' Bosque Elm	Y	Y	N	40-45'	45-50'	DECID	FS	WD, OW	MOD	MOD	(4.8-7.5)	Y
Ulmus parvifolia 'Drake' Drake Elm	Y	Y	N	35-40'	35-50'	DECID	FS, PS	WD, OW	MOD	MOD	(4.8-7.5)	Y
Ulmus parvifolia 'Emer I' Athena Elm	Y	Y	N	40-45'	45-50'	DECID	FS	WD, OW	MOD	MOD	(4.8-7.5)	Y
[10] LARGE TREES												
Acer rubrum Red Maple	Y	Y	Y	60-75'	25-35'	DECID	FS, PS	OW, W	LOW	MOD	(5.4-7.1)	Y

TREE COMMISSION
APPROVED TREE PLANTING LIST

Tree	Right of Way	Parks	DCPS[14]	Expected Full Grown Height	Expected Full Grown Spread	[2] Foliage	[3] Light Required	[4] Soil Drainage	[5] Drought Tolerance	[6] Growth Rate	Soil Tolerance (pH)	[13] IFAS FL Friendly
Carya sp. Hickory	N	Y	N	50 - 60'	30-40'	DECID	FS, PS	WD	MOD	SLOW	(4.8-7.5)	Y
Catalpa bignonioides Catalpa	Y	Y	N	55-60'	40-60'	DECID	FS, PS	WD, OW, W	MOD	FAST	(4.5-6.0)	Y
Curpressocyparis leylandii Leyland cypress	Y	Y	N	30-40'	20-30'	E'GRN	FS, PS	WD	HIGH	SLOW	(5.5-8.0)	Y
Diospyros virginiana Persimmon	N	Y	N	30 - 60'	20-35'	DECID	FS, PS	WD	MOD	SLOW	(3.5-6.5)	Y
Fraxinus caroliniana Green Ash	Y	Y	N	60-70'	45-50'	DECID	FS	WD, OW, W	HIGH	FAST	(5.0-7.5)	Y
Gordonia lasianthus Loblolly Bay	Y	Y	N	35-60'	10-15'	E'GRN	FS, PS	WD, OW, W	MOD	MOD	(4.8-7.5)	Y
Liqudambar straciflua Sweetgum	Y	Y	Y	60-75'	35-50'	DECID	FS, PS	WD, OW	LOW	MOD	(4.5-7.5)	Y
Liriodendron tulipifera Tulip Poplar	Y	Y	N	80-100'	30-50'	DECID	FS, PS	WD, OW	MOD	FAST	(4.5-7.5)	Y
Magnolia grandiflora Southern Magnolia	Y	Y	N	30-100'	20-40'	E'GRN	FS, PS	WD, OW	MOD	MOD	(5.5-7.5)	Y
Nyssa sylvatica Blackgum	Y	Y	N	65-75'	25-30'	DECID	FS, PS, SH	WD, OW, W	HIGH	SLOW	(6.0-7.0)	Y
Oxydendron arboreum Sourwood	Y	Y	N	40-60'	25-30'	DECID	FS, PS	WD	MOD	SLOW	(3.5-6.5)	Y
Pinus echinata Shortleaf Pine	Y	Y	N	80-100'	25-30'	E'GRN	FS, PS	WD	HIGH	FAST	(4.5-6.5)	Y
Pinus elliottii Slash Pine	Y	Y	N	60-80'	30-40'	E'GRN	FS, PS	WD, OW	HIGH	FAST	(4.5-7.0)	Y
Pinus glabra Spruce Pine	Y	Y	N	30-60'	25-40'	E'GRN	FS, PS	WD, OW	MOD	SLOW	(4.5-7.0)	Y
Pinus palustris Longleaf Pine	Y	Y	N	60-80'	30-40'	E'GRN	FS, PS	WD	HIGH	MOD	(4.5-7.0)	Y
Pinus taeda Loblolly Pine	Y	Y	N	60-80'	30-40'	E'GRN	FS, PS	WD, OW	MOD	FAST	(4.5-7.0)	Y
Platanus occidentalis American Sycamore	Y	Y	N	75-90'	50-70'	DECID	FS	WD, OW	MOD	FAST	(4.9-8.0)	Y
Quercus austrina Bluff Oak	Y	Y	N	40-60'	35-50'	DECID	FS, PS	WD, OW	HIGH	MOD	(4.5-6.0)	Y
Quercus laurifolia Laurel Oak	Y	Y	Y	40-60'	40-60'	DECID	FS, PS	WD, OW	MOD	FAST	(4.5-6.0)	Y
Quercus lyrata	Y	Y	Y	35-50'	30-50'	DECID	FS, PS	WD, OW, W	LOW	MOD	(4.5-6.0)	Y

TREE COMMISSION
APPROVED TREE PLANTING LIST

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Overcup Oak												
Quercus michauxii Swamp Chestnut Oak	Y	Y	Y	60-70'	30-50'	DECID	FS, PS	WD, OW, W	LOW	MOD	(4.5-6.0)	Y
Quercus nuttallii Nuttall Oak	Y	Y	Y	60-80'	35-50'	DECID	FS	WD, OW	LOW	MOD	(4.5-5.5)	Y
Quercus phellos Willow Oak	Y	Y	N	60-75'	40-50'	DECID	FS	WD, OW, W	HIGH	FAST	(4.5-6.5)	Y
Quercus shumardii Shumard Oak	Y	Y	Y	70-80'	50-60'	DECID	FS, PS	WD, OW, W	HIGH	FAST	(4.5-5.5)	Y
Quercus virginiana Live Oak	Y	Y	Y	60-80'	60-120'	E'GRN	FS, PS	WD, OW	HIGH	MOD	(4.5-8.0)	Y
Salix babylonica or alba Weeping Willow	Y	Y	N	45-70'	45-70'	DECID	FS, PS	WD, OW	MOD	FAST	(4.5-7.5)	Y
Taxodium distichum Bald Cypress	Y	Y	Y	60-80'	25-30'	DECID	FS, PS	WD, OW, W	MOD	MOD	(4.0-7.5)	Y
Ulmus parvifolia 'Emer II' Allee Elm	Y	Y	N	40-75'	35-50'	DECID	FS, PS	WD, OW	HIGH	MOD	(4.8-7.5)	Y
PALMS												
Livistona decipiens Ribbon Palm	Y	Y	Y	30-50'	18-25'	E'GRN	FS	WD, OW	HIGH	MOD	(5.5-7.5)	Y
Sabal palmetto Cabbage Palm	Y	Y	Y	40-50"	5-10'	E'GRN	FS	WD, OW	HIGH	MOD	(6.0-8.0)	Y
Washingtonia robusta Washington Palm	Y	Y	Y	60-100'	10-15"	E'GRN	FS, PS	WD, OW	HIGH	FAST	(5.5-8.0)	Y

TREE COMMISSION APPROVED TREE PLANTING LIST												
Tree	**Right of Way**	**Parks**	**DCPS[14]**	**Expected Full Grown Height**	**Expected Full Grown Spread**	**[2] Foliage**	**[3] Light Required**	**[4] Soil Drainage**	**[5] Drought Tolerance**	**[6] Growth Rate**	**Soil Tolerance (pH)**	**[13]IFAS FL Friendly**

LEGEND:

Yaupon Holly *Ilex vomitoria*	If planting area is likely contaminated with limerock or if the soil pH is tested above 7.5, then concentrate on trees shown in gray that are tolerant of alkaline soils.

NOTES:

[1] Draw each tree symbol on the landscape plan to the diameter shown above to match the normal mature (20 year) canopy of each tree species. Do not overlap tree canopies of different species (ie, do not show the canopy circle of a sun loving crape myrtle overlapping the mature canopy circle of a live oak). However, tree canopy circles of the same species can overlap to create tree clusters or to create a solid, closely spaced row of trees. Also, new understory trees can be shown under existing shade trees if existing trees have high branching.

[2] Foilage: DECID = Deciduous, E'GRN = Evergreen

[3] Light Requirement: FS = Full Sun, PS = Partial Shade (2-5 hrs. of sun or filtered sun), SH = Full Shade (<2 hrs. sun)

[4] Soil Drainage: W=Always Wet (soil saturated for more than several days during growing season), OW=occasionally Wet (Soil saturated for several days during several days of growing season), WD=Well Drained

[5] Drought Tolerance: HIGH=High (no watering required once well established), MOD= Moderate (occasional watering required during dry periods in growing season), LOW= Low (frequent watering required during dry periods of growing season)

[6] Growth Rate: SLOW=Slow (<1ft/ yr.), MOD=Moderate (1-2 ft/ yr.), FAST=Fast (>2ft/ yr.)

[7] Use **Live Oak** cultivars (Q. v. 'SDLN' ('Cathedral' Live Oak) or Q. v. 'QVTIA ('Highrise' Live Oak)) in medians when a single row of oaks with uniform spacing is desired. Use 'Highrise' Oak where oaks are near overhead power lines. Use common live oak for informal groupings.

[8] Limit use of **River Birch, Red Maple, and Weeping Willow** to clusters around retention ponds and in areas of R.O.W. undisturbed by construction. Do not use in medians or within 20' of pavement. These trees don't do well in alkaline conditions generally found near pavement. Because River Birch and Willows have a short life span, use these tree sparingly. Generally, cluster with longer lived tree types.

[9] Use **Wax Myrtle** only in mass planting for visual screening and transition into natural areas.

[10] Provide 6'-8' minimum between Large Trees and pavement, curbs and other structures.

[11] Trees not on the above approved list may be considered for approval by the Tree Commission. (www.coj.net/departments/public-works/tree-commission)

[12] Because of weeping nature of **Drake Elm**, limit use to medians 30' wide or greater, measured from the edge of travel lane (i.e. two 1.5' curb & gutter & 27' grassed median) and where the tree can be set back 15' from the travel lane, if planted on the side of the street.

[13] The definition of **Florida-Friendly Landscaping™** in Florida Statutes section 373.185 (adopted in 2009 in Senate Bill 2080) addresses "quality landscapes that conserve water, protect the environment, are adaptable to local conditions, and are drought tolerant. The principles of such landscaping include planting the right plant in the right place, efficient watering, appropriate fertilization, mulching, attraction of wildlife, responsible management of yard pests, recycling yard waste, reduction of stormwater runoff, and waterfront protection. Additional components include practices such as landscape planning and design, soil analysis, the appropriate use of solid waste compost, minimizing the use of irrigation, and proper maintenance."

[14] **DCPS**=Duval County Public Schools. When landscaping on Public Educational Facilities in Florida (including colleges and universities), please refer to **State Requirements for Educational Facilities** manual for a comprehensive description of planting standards at www.flrules.org.

BRINGING ORDER TO THE TECHNICAL DYSFUNCTION WITHIN THE URBAN FOREST[1]

by James Urban

In order to increase the success rate of trees planted in the urban environment, there must be a significant change in the way trees are planted. The wide diversity in soil conditions found within urban areas suggests that there should be modifications to planting details from one site to another. The profession of urban forestry and landscape architecture, however, continue to use the same planting details regardless of the quality of the existing soil. Further, no protocol exists to guide the decision making process to determine when to use different methodologies.

This paper will present the framework for such a methodology and a series of possible changes to the way trees should be planted. The methodology is based on quantifiable levels of urbanization and soil quality, and proposes a logical approach to the design of planting details.

A major impasse to the development of a healthy urban forest is the technical dysfunction within the professions of urban forestry and landscape architecture with respect to the details of planting trees. The average professional knows little about how a tree actually grows. They are not skilled in the mechanics and dynamics of soil, roots and water and they are not aware of the impact these dynamics have on performance. Current planting practices are designed for the most benign sites; where soil is generally suitable to support root growth, is well drained, and is available in large quantities. Unfortunately, the urban forest is a continuum of soil conditions which range from these good sites to sites that have little or no drainage and where the soil is of such inferior quality and structure that it will not allow root penetration or function.

Urban forestry practices have largely relied on tree selection or "the right tree in the right place" as the primary method to overcome more difficult sites. Current research suggests that many urban sites are so severe that no species will reliably work. Modification of the site soil and drainage capability is often the only solution to successful growing of trees. On better sites, modification of the planting area could be used to broaden the number of species that will be predictably successful.

Predictability and success are the key words. When a professional forester or landscape architect is relied upon to specify a tree planting, the person investing in the cost of the tree should have some reasonable assurance that the tree will grow to meet some predetermined level of success. It is one of our profession's obligations to either ensure that the site is made suitable for the trees' growth potential or to define for our clients how much growth they should expect out of a given tree in a given site.

Site modification, however, is expensive and requires specific solutions for each problem. Currently, there are few guidelines or standards to assist in the designing of site modification procedures. Practitioners who attempt to propose new planting details are often viewed as extravagant and individual designers often come up with widely varying solutions to similar problems. The following protocol is proposed to begin to set standards for site modification and the design of planting sites. It is designed as a guide to help predetermine how much site modification is necessary to successfully grow large trees. The protocol is based on the principle that soil is the primary factor influencing tree growth in urban areas. It is necessary for a tree to have access to sufficient rooting space in order to grow properly. Since both soil quality and soil quantity are critical to the equation, a methodology is proposed to accommodate each factor.

1. Presented at the annual conference of the International Society of Arboriculture in Philadelphia in August 1991.

Site Modification Protocol

Step one - *Determining Soil Quality.* Soil quality is primarily a function of how much the soil has been graded or disturbed and how much the soil has been compacted. Each site (or portion of the site) should be evaluated to predict what the conditionof the soil will be after construction is completed. While soil quality is a continuum, the protocol will establish four classifications of soil quality as follows: 1) not graded and not compacted, 2) not graded but compacted, 3) graded but not compacted, 4) graded and compacted (Figure 1).

Definitions. The term *graded* is defined as a soil that has had its 'A' horizon disturbed, removed and not replaced or a soil that has had its 'A' and 'B' horizon moved from one location to another. The term *compacted* is defined as a soil that has been compressed to a bulk density which prohibits root growth (greater than 1.6 gr/cm). it is very difficult to predict how much the construction process will compact soil. Worse case assumptions should be used.

Step two- *Determining Level of Urbanization.* The second soil factor affecting tree growth is the quantity of soil available to the tree. This protocol chooses to measure urbanization or the aggregate of total development on a site, as an effective measuring gauge of the amount of soil "likely" to be available. Urbanization actually affects two important elements. One, the amount of soil left as available to the tree, and two, the amount of resources available per tree to modify the planting site. The higher the intensity of use of a site, the more money that may be spent on tree planting. Urbanization, like soil disturbance, is a continuum. For the purpose of this protocol, levels of urbanization will be defined based on the % of impervious surface remaining after construction, as follows: 1) less that 15%, 2) 15% - 50%, 3) 50% - 75%, 4) 75% - 90%, 5) 90% or greater (Figure 2).

Step three - *Find the Sites Minimum Design Criteria.* Soil disturbance and urbanization are put on the axis of the Minimum Design Criteria Matrix (Figures 3 & 4). In each of the resulting 20 positions are recommendations for minimum design criteria to be used when preparing planting details. The recommendations are made for the three critical design elements that affect tree growth. These are soil modification, drainage modification and aeration modification. The recommendations are made using a numerical code which is referenced in the following sections. By using these criteria, minimum details can be developed. Not all situations, however, will match these criteria. If conditions exist which suggest that a different criterion would be more appropriate, then it may be substituted provided that the designer understands the impact on the tree of this change.

Soil Modification Procedures

The following list describes optional methods of soil modification that can be included into planting

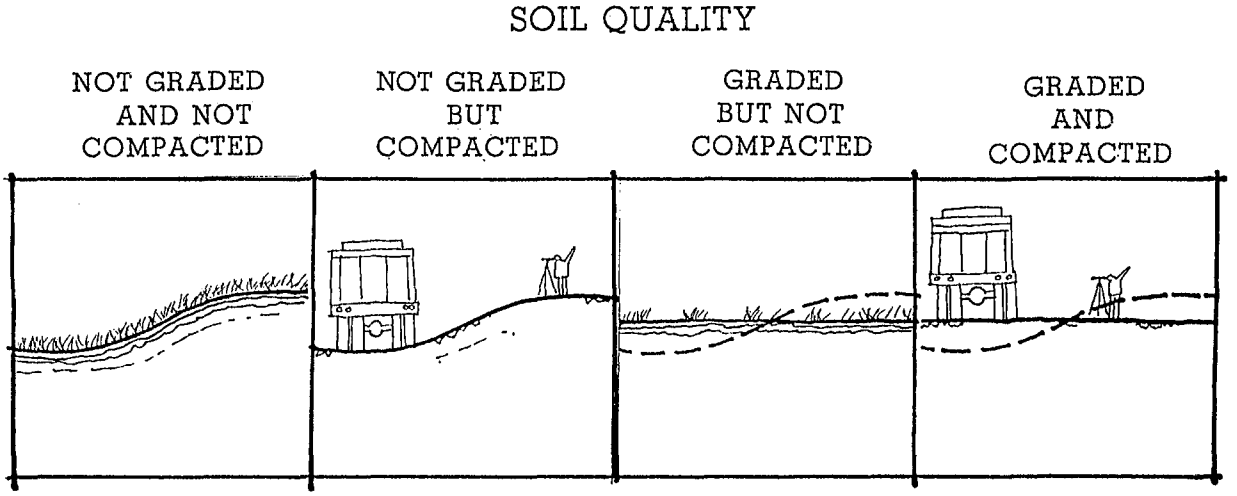

Figure 1

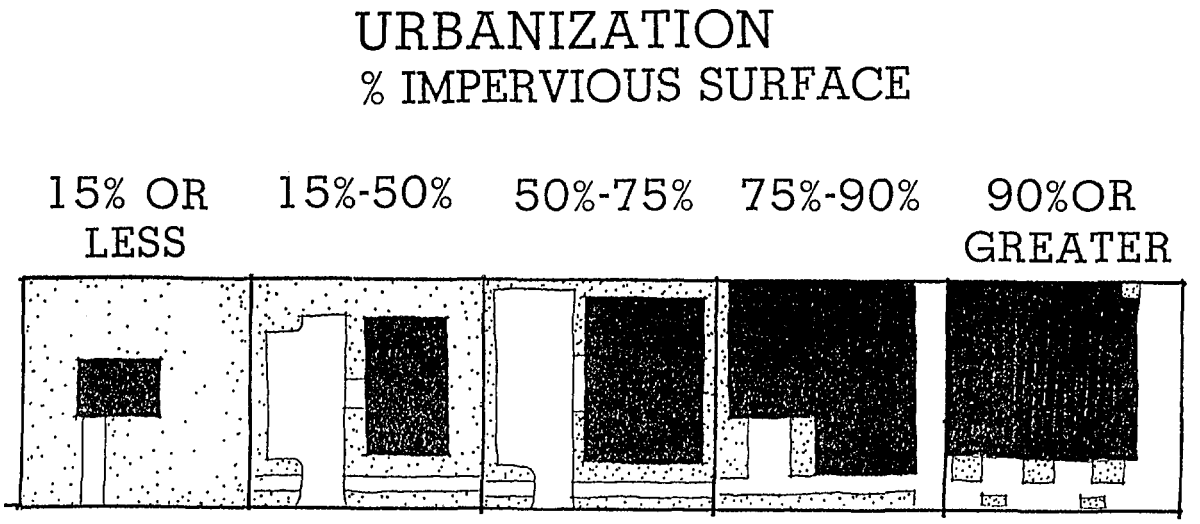

Figure 2

details. They are ranked from the least to the most complex of procedures. Providing enough soil, of suitable quality to support the tree mass proposed in a given location must be accounted for in the earliest phases of the project.(The codes refer to Figure 4.)

S1. Dig the planting hole 60 cm (24 in) larger in diameter than the diameter of the root ball. Back fill with the unamended soil excavated from the hole

S2. Dig the planting hole 180 cm (6 ft) larger in diameter than the diameter of the root ball. Back fill with the unamended soil excavated from the hole.

S3. Dig the planting hole 180 cm (6 ft) larger in diameter than the diameter of the root ball. Excavate the remaining areas of soil in planters and lawn to a depth of 20 cm (8"). Till the resulting subgrade with the first 10-15 cm (4-6 in) of planting soil mix.

S4. Excavate all areas available for planting and lawn to a depth of 75 cm (2.5 ft). Till the resulting subgrade with the first 10-15 cm (4-6 in) of planting soil mix. Calculate the quantity of planting soil mix to determine that the volume of soil per tree being provided is sufficient to grow the tree specified (Figure 5). Modify the design to allow for adequate soil volume.

S5. Perform the requirements of Step S4. Design additional subsurface soil volumes below the adjacent paving as required to provide all adequate soil volume (Figure 5). Interconnect these soil volumes whenever possible.

MINIMUM DESIGN CRITERIA MATRIX

GUIDE

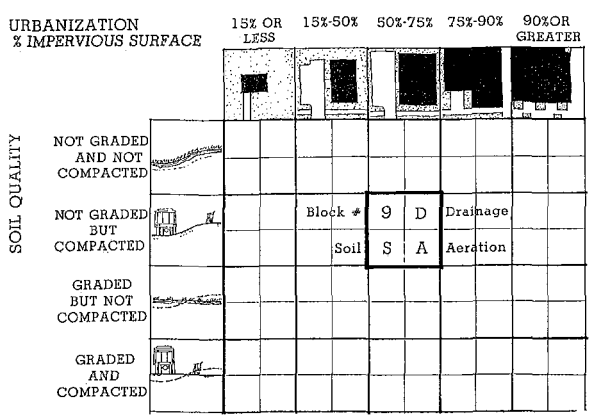

Figure 3

Definitions:

Planting soil mix. A sandy loam comprised of a majority of medium to coarse sands. This soil should have a percolation rate when fully compacted of at least 2 inches per hour.

Soil volume. All soil that is available to the roots of the tree that is of suitable quality for root

MINIMUM DESIGN CRITERIA MATRIX

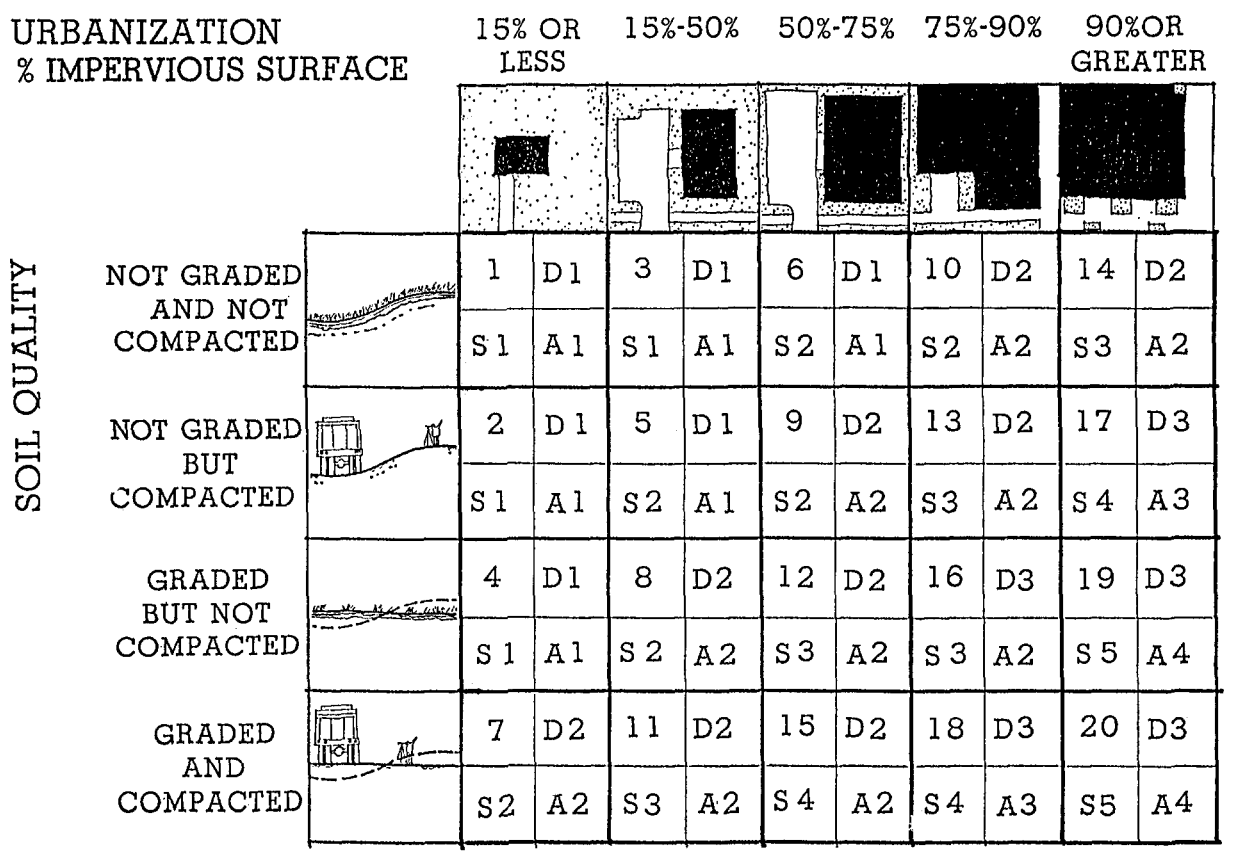

Figure 4

growth (well drained, not compacted, and possessing adequate pore space). The maximum depth for this calculation is normally 75 cm (2.5 ft).

Drainage Modification Procedures

The following list describes optional methods of drainage modification that can be included in planting details. They are ranked from the least to the most complex of procedures. Adequate drainage is required to obtain root growth in the soil. Soil modification without attention to drainage can lead to saturated soils that will not support tree growth. (The codes refer to Figure 4.)

D1.1. Percolation of existing soil 5 cm (2 inches) per hour or greater. Provide positive surface drainage, minimum of 2%.

D1.2. Percolation of existing soil 2.5-5 cm (1-2 inches) per hour. Increase surface slopes in planting areas to 10% away from the tree.

D1.3. Percolation of existing soil less than 2.5 cm (1 inch) per hour. Mound planting soil in the area of the tree at 20% so that the root ball is entirely above the existinggrade and/or add subsurface drain lines around the tree and loosen the soil to a depth of 30 cm (12 in).

D2. Unpredictable percolation. Move existing water away from the site by providing subsurface drain lines within the planting area and/or provide a drain sump pit at each tree. Perform a percola-

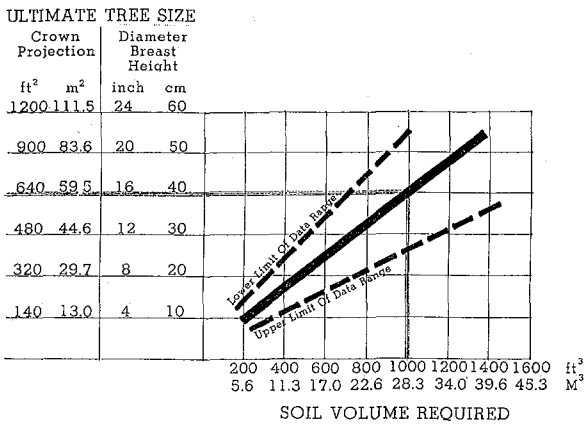

Figure 5. The data on this chart represent a synthesis of several studies attempting to establish the relationship between tree growth and soil volume. See citations 7,8,9,13.

tion test at each tree. Apply criteria of D1.1 - D1.3 above.

D3.1. Trees within new paving, provide subsurface drain lines to remove water from the site which connect from tree to tree.

D3.2. Trees within existing paving, perform a percolation test. If the percolation of the existing soil is 2.5 cm (1 in) per hour or greater, install drainage sump with subsurface drain line ring around the tree. If the percolation of the existing soil is less than 2.5 cm per hour, **do not plant** the tree unless drainage can be improved.

Definitions

Percolation test. Dig a hole 15 to 25 cm (6 - 10 inches) in diameter and 25 cm deep, fill the hole with water and allow it to drain. Refill the hole with water and measure the rate of water percolation out of the hole.

Drainage sump. A hole 20 to 30 cm (8 - 12 inches) in diameter by at least 1 m (3 ft) deep measured from the bottom of the planting hole. Insert a 10 cm (4 inches) diameter perforated pipe which extends up to grade and backfill with coarse gravel. Drainage sumps are only effective if they reach a pervious layer.

Aeration Modification Procedures

The following list describes optional methods of aeration modification that can be included in planting details. They are ranked from the least to the most complex of procedures. The ability of soils to conduct air to the root zone is critical. Where soil volumes are restricted, new details, which allow more air to get deeper into the soil, will greatly increase the effectiveness of the available soil. (The codes refer to Figure 4.)

A1. Provide for periodic aeration and/or mulching of the ground within the dripline of the tree.

A2. Provide aeration sheets along accessible surfaces, i.e., foundations, curbs, etc.

A3.1. With existing paving, provide aeration sheets within the planting area.

A3.2. With new paving, provide aeration sheets within the planting areas and under paved areas. Install coarse gravel subbase under all paved areas. Install open joint unit pavers where applicable.

A4. Install watering tubes within the gravel subbase plus provide A3 requirements.

Definitions

Aeration sheets. Three dimensional drainage cores covered on both sides with a geotextile fabric. The sheets should be 30 to 45 cm (1 -1.5 ft) wide and be placed in a vertical position in order to be effective. Aeration sheets are currently made by: American Enka Co., Enka, NC (Enka Drain # 9228); American Wick Drain Corp., Matthews, NC (Akwa Drain 112) and Mirafi Corp., Charlotte, NC (Miradrain 4000).

Watering tubes. Five cm (2 in) diameter perforated tubes that conduct water from a surface source into the gravel under the paving.

Other Determinants That Affect Tree Growth

There are a number of other factors that affect planting detail design but are not easily accounted for in this protocol. Each of these will have to be considered by the designer and appropriate modifications to the recommendations must be considered.

Soil Texture. Extremes of very sandy, silty or clayey soils are not accounted for in this protocol. When these soils are encountered, follow the recommendations of a soil scientist.

Soil Profile. Unusual soil profiles such as fragipans, hardpans, shallow rock formations or under-

ground structures will require special details.

Site History. The age of the buildings and site work can have a significant impact on the opportunities for root growth. Sites developed prior to 1940 may require less site modification to grow successful trees due to the differences in the way land was developed. Sites that have had several changes in the configuration of buildings and grades may require more site modifications than may be indicated by the protocol. Each layer of change introduces disruption to the soil structure that is often hard to determine by visual site inspection.

Project Maintenance. These recommendations assume that some minimum maintenance will be available on a long term basis. This would include regular pruning, watering during the initial transplant period, and some ongoing insect and disease control. Less maintenance will require more site modification to grow similarly sized trees while more maintenance, particularly irrigation and fertilization, will allow for slightly less site modification.

Conclusions

The state of urban forestry must continue to evolve if successful urban forests are to be grown and maintained. New partnerships and institutions will have to be forged and new standards will have to be set. Much of the technical information we currently rely on will have to be set aside in favor of new ideas that will be based on research and documented experience. The protocol for tree planting detail design outlined above is only one small step in this process.

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Landscape Architect
Urban and Associates
915 Creek Drive
Annapolis, Maryland 21403

Bringing Order to the Technical Dysfunction within the Urban Forest

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Current planning practices are designed for the most benign sites; where soil is generally suitable to support root growth, is well drained, and is available in large quantities.

Unfortunately, the urban forest is a continuum of soil conditions which range from these good sites to sites that have little or no drainage and where soil is of such inferior quality and structure that it will not allow root penetration or function.

Urban forestry practices have largely relied on tree selection or the "right tree in the right place" as the primary method to overcome more difficult sites.

Current research (1991) suggests that many urban sites are so severe that no species will reliably work.

Modification of the site soil and drainage is often the only solution to successful growing of trees.

On better sites, *modification of the planting area* could be used to broaden the number of species that will be predictably successful.

When a professional forester or landscape architect is relied upon to specify a tree planting, the person investing in the cost of the tree should have some reasonable assurance that the tree will grow to meet some predetermined level of success.

GUIDE TO HELP PREDETERMINE HOW MUCH SITE MODIFICATION IS NECESSARY TO SUCCESSFULLY GROW LARGE TREES.

Perform a conditions assessment (after construction is completed, or if infill, current conditions):

Soil Quality	Not Graded and Not Compacted
	Not Graded But Compacted
	Graded but Not Compacted
	Graded and Compacted
Graded	topsoil removed or disturbed and relocated on site
Compacted	compressed to a bulk density that prohibits root growth (worst case should be assumed)
Impervious Surface	less than 15% impervious
	15% - 50 % impervious
	50% - 75% impervious
	75% - 90 % impervious
	over 90% impervious
Degree of Urban	percent of impervious surface remaining

Identify the Minimum Design Criteria:

Soil Quantity Goal : provide enough soil, of suitable quality to support the tree mass proposed in a given location.

Matrix Standards:	S1	Dig the planting hole 24 inches larger in diameter than the root ball diameter. Backfill with unamended soil excavated from the hole.
	S2	Dig the planting hole 6 feet larger in diameter than the root ball dimeter. Backfill with unamended soil excavated from the hole.
	S3	Dig the planting hole 6 feet larger in diameter than the root ball diameter. Excavate the remaining area of soil in planters and lawn to a depth of 8 inches. Till the resulting subgrade with the first 4-6 inches of planting soil mix.
	S4	Excavate all areas available for planting and lawn to a depth of 2.5 feet. Till the resulting subgrade with the first 4-6 inches of planting soil mix. Calculate the quantity of planting soil mix to determine that the volume of soil per tree being provided is sufficient to grow the tree specified. Modify the design to allow for adequate soil volume.
	S5	Perform the requirements of Step S4. Design additional subsurface soil volumes below the adjacent paving as required to provide all adequate soil volume. Interconnect these soil volumes when possible.
	Planting Soil	a sandy loam comprised of a majority of medium to coarse sands. This soil should have a percolation rate when fully compacted of at least 2 inches per hour
	Soil Volume	all soil that is available to the roots of the tree that is of suitable quality for root growth (well drained, not compacted, possessing adequate pore space). Maximum depth for this area is normally 2.5 feet.

Drainage Goal: Drainage adequate to obtain root growth in the soil.

Matrix Standards:	D1.1	Percolation of existing soil 2 inches / hour or greater. Positive surface drainage, min. 2%.
	D1.2	Percolation of existing soil 1- 2 inches / hour or greater. Increase positive surface drainage in planting areas to 10% away from the tree (mounding)
	D1.3	Percolation of existing soil less than 1 inch/ hour or greater. Mound planting soil in area at least 20% so rootball is entirely above existing grade OR add subsurface drain lines around tree and loosen soil to a depth of 12 inches.
	D2	Unpredictable percolation. Move existing water away from the site by providing subsurface drain lines within planting area and/ OR provide a drain sump pit at each tree. Perform perc test at each tree; apply D1.1, 1.2 or 1.3 criteria.
	D3.1	Trees within new paving, provide subsurface drain lines to remove water from the site which connect from tree to tree.

	D3.2	Trees within existing paving, perform a perc test. If the perc of existing soil is 1 inch/hour or greater, install drainage sump with subsurface drain line in ring around tree. If perc is less than 1 inch/hour, do not plant trees unless drainage is improved.
	Perc test	Dig a hole 6-10 in in diameter and 10 in deep; fill with water and allow to drain. Refill with water; measure the rate of water percolation out of the hole.
	Drainage sump	A hole 8-12 inches dia by min. 3 foot depth*, measured from the bottom of the planting hole. Install a 4' perforated pipe extending to grade ; backfill with coarse gravel.*Depth must reach pervious layer.

Aeration Goal: **Provide sufficient air to the root zone to address effectiveness of the available soil.**

Matrix Standards:	A1	Provide for periodic aeration and/or mulching of the ground within the dripline of the tree.
	A2	Provide aeration sheets along accessible surfaces (foundations and curbs)
	A3.1	Within existing paving, provide aeration sheets within the planting area.
	A3.2	With new paving, provide aeration sheets within the planting areas and under paved areas. Install coarse gravel subbase under all paved areas. Install open joint unit pavers were applicable / specified to achieve minimum pervious planting area.
	A4	Install watering tubes within the gravel subbase plus meet A3 requirements.
	Aeration sheet	Three dimensional drainage cores covered on both sides with geotex fabric. Sheets to be 1-1.5 feet wide, placed vertically.
	Watering tube	2 inch dia perforated tubes that conduct water from a surface source to the gravel under the paving.

Contributing Factors: **Address as required:**

Soil Texture	Very sandy, silty or clayey soils require recommendations of a soil scientist. Require ID of soils present to determine need for report/ consultation.
Soil Profile	Unusual soil profiles require special details (hardpan, shallow rock, underground structures).
Site History	Age of buildings and site work affects the likelihood of disrupted soil structure. Prior to 1940, site work resulted in less impact to the soil based on the way land was developed. Sites that have had several changes in configuration (grades and/or structures) may require more site modifications than indicated.
Maintenance	Recommendations all assume some minimum maintenance is available on a long term basis. This includes regular pruning, watering during initial grow-in period, and some ongoing insect and disease control. Less maintenance will require more site modification to grow similarly sized trees. More, partiiculary, irrigation and fertilizer, will allow for slightly less site modification.

Minumum Design Criteria Matrix

Soil Quality	% Impervious	15% or Less Impervious		15% -50% Impervious		50%-70% Impervious		70% - 90% Impervious		90% or More Impervious	
	Not Graded AND	**1**	D1	**3**	D1	**6**	D1	**10**	D2	**14**	D2
	Not Compacted	S1	A1	S1	A1	S2	A1	S2	A2	S3	A2
	Not Graded BUT	**2**	D1	**5**	D1	**9**	D2	**13**	D2	**17**	D3
	Compacted	S1	A1	S2	A1	S2	A2	S3	A2	S4	A3
	Graded BUT	**4**	D1	**8**	D2	**12**	D2	**16**	D3	**19**	D3
	Not Compacted	S1	A1	S2	A2	S3	A2	S3	A2	S5	A4
	Graded AND	**7**	D2	**11**	D2	**15**	D2	**18**	D3	**20**	D3
	Compacted	S2	A2	S3	A2	S4	A2	S4	A3	S5	A4

source: Bringing Order to the Technical Dysfunction within the Urban Forest, Urban, 1991