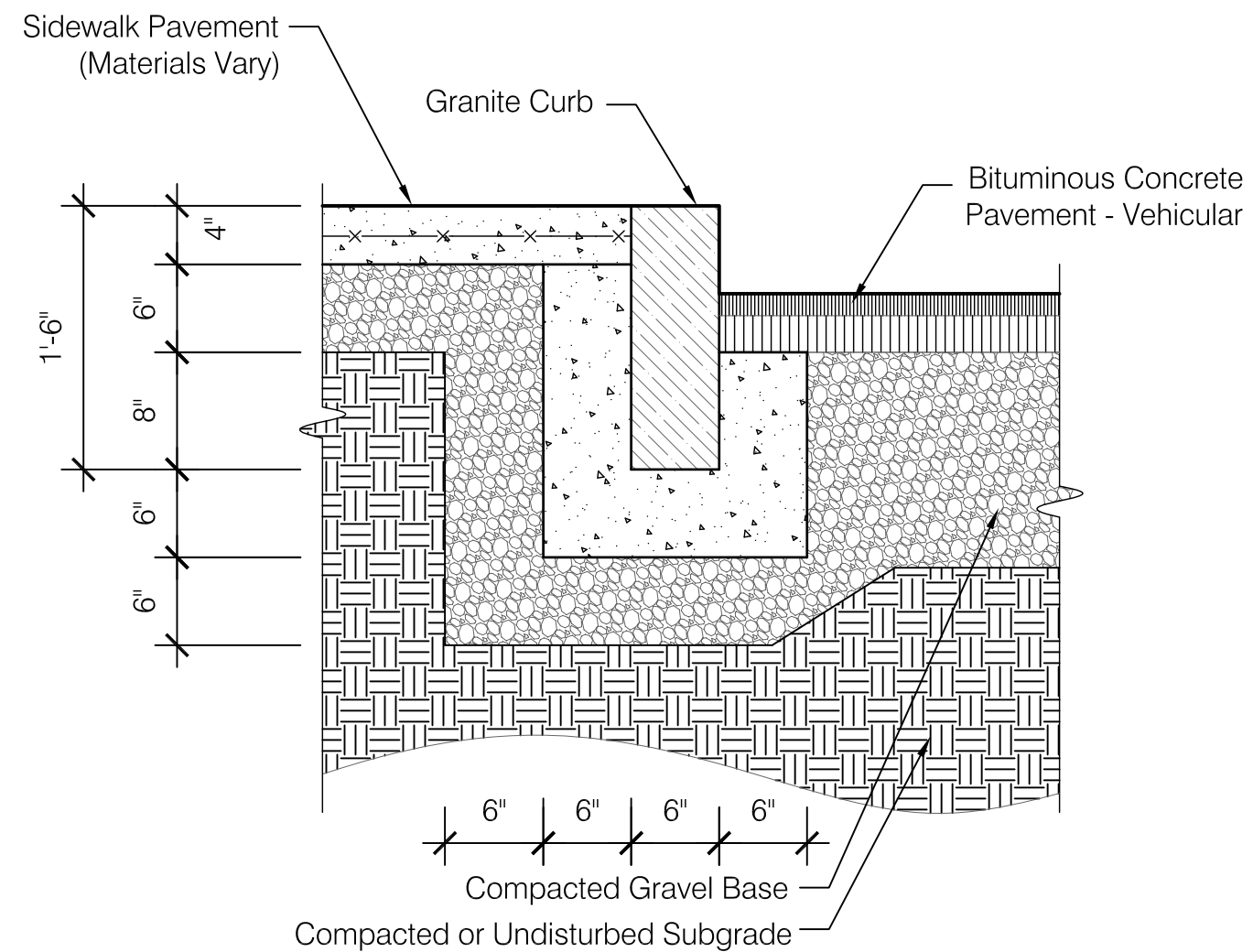




Appendix A-1: Streetscape Details

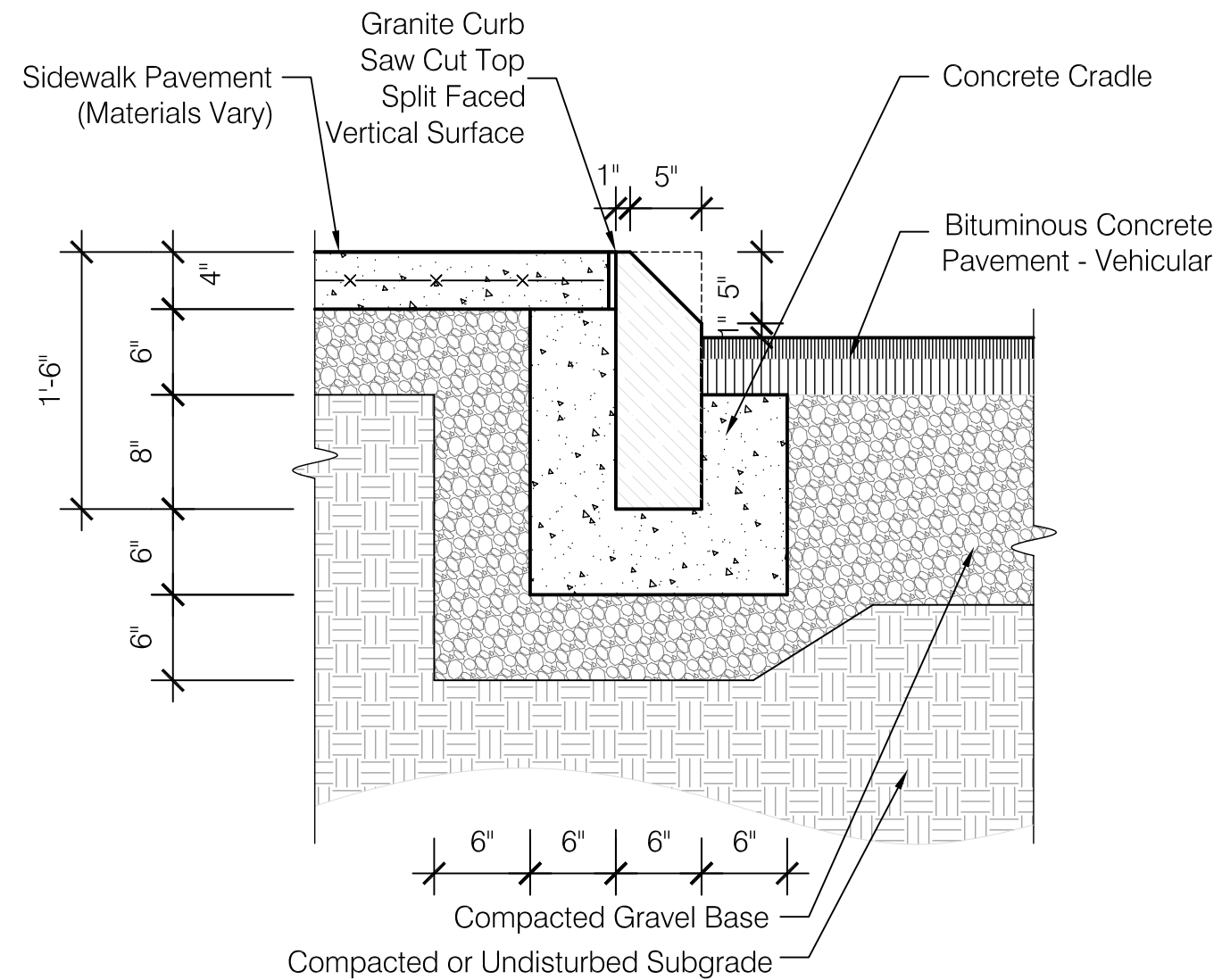


Granite Curb

Section

Notes:

- 1.Begin installing granite curb for all future development and infrustructural projects wihtin the master plan area.

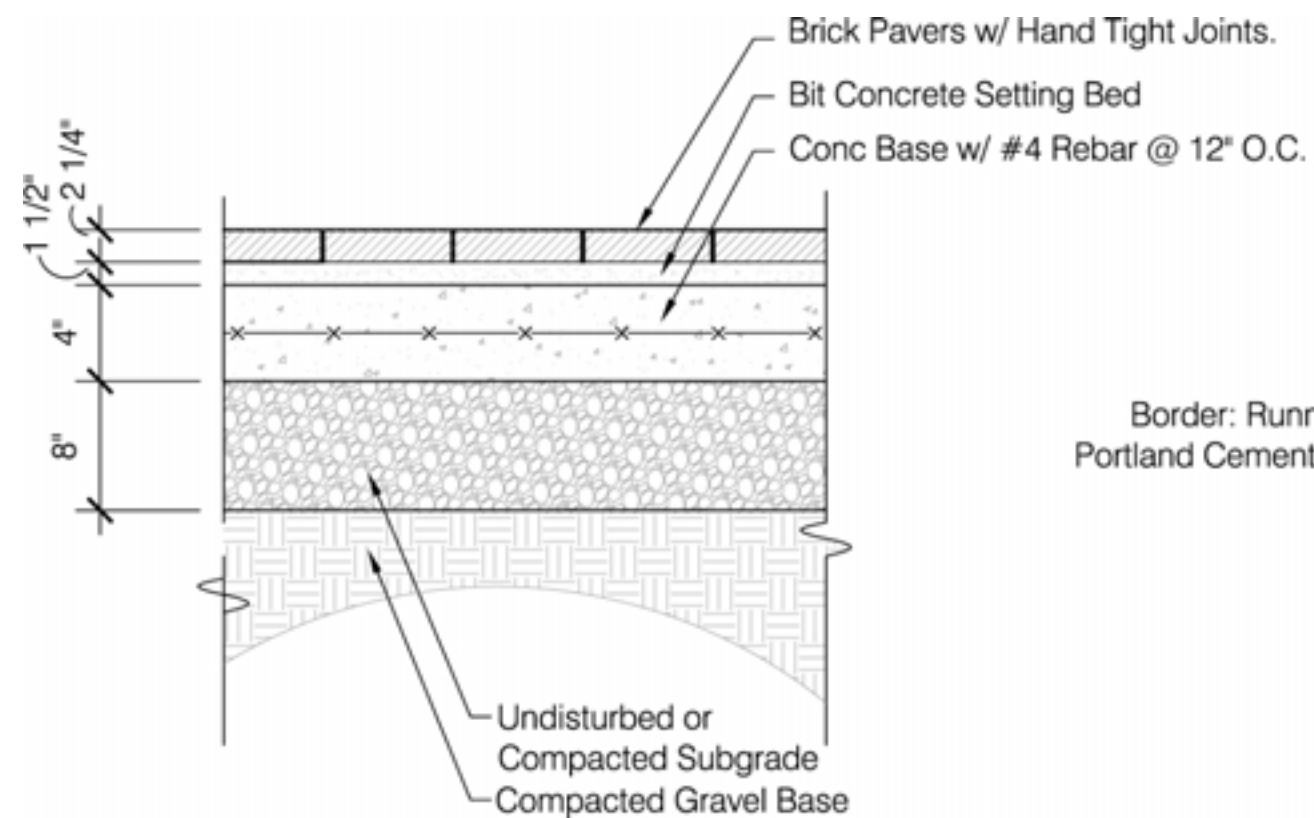


Sloped Granite Curb

Section

Notes:

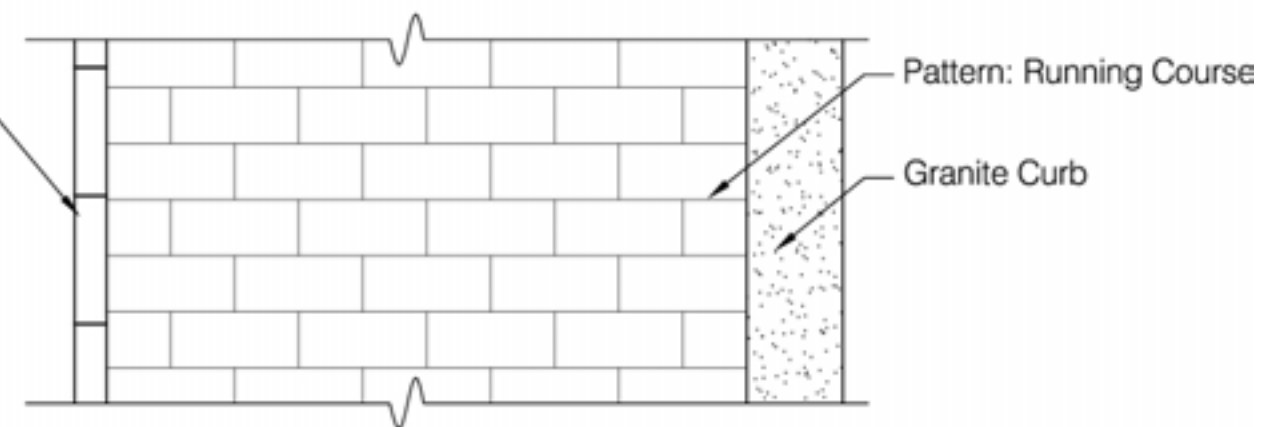
1. Provide sloped curbs at locations where vehicles are required to access sidewalks or plazas
2. Begin installing granite curb for all future development and infrastructural projects within the master plan area



Brick Sidewalk

Section

Border: Running Course With Portland Cement Mortared Joints

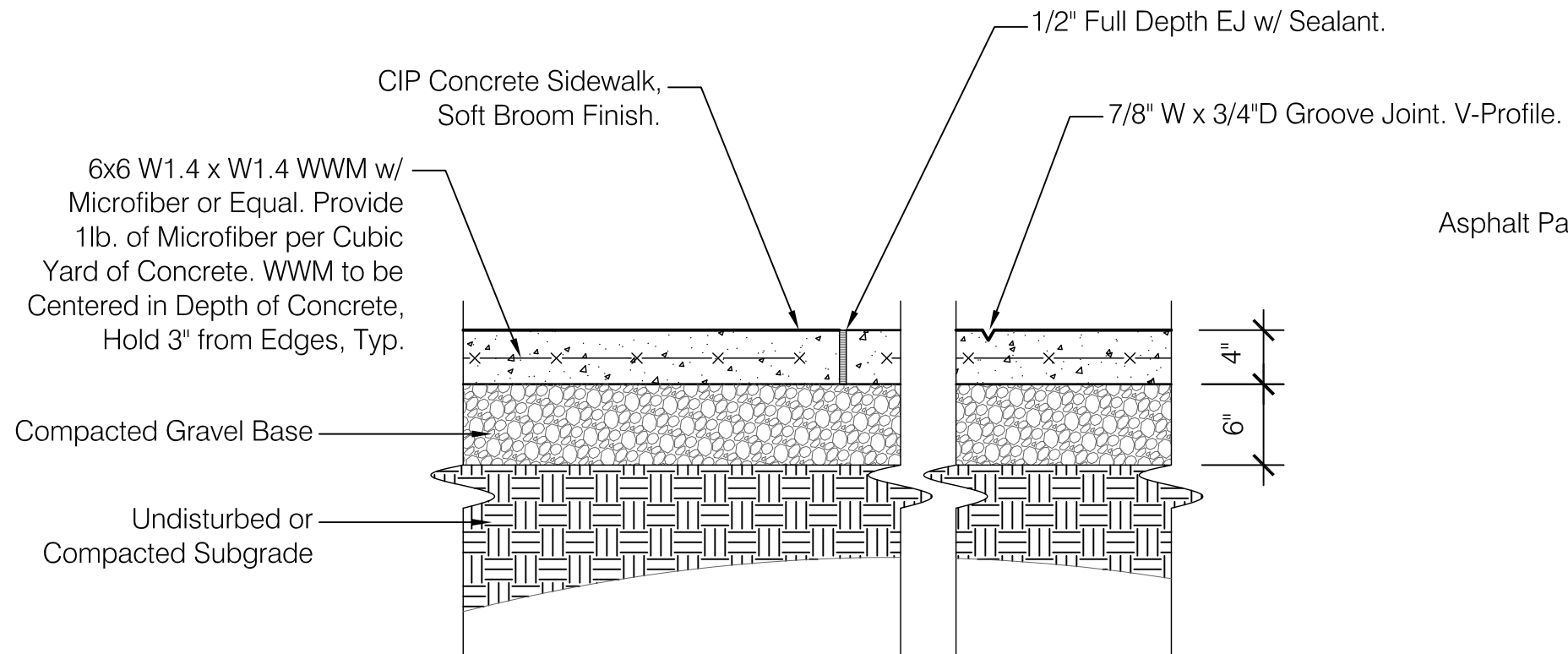


Brick Sidewalk

Plan

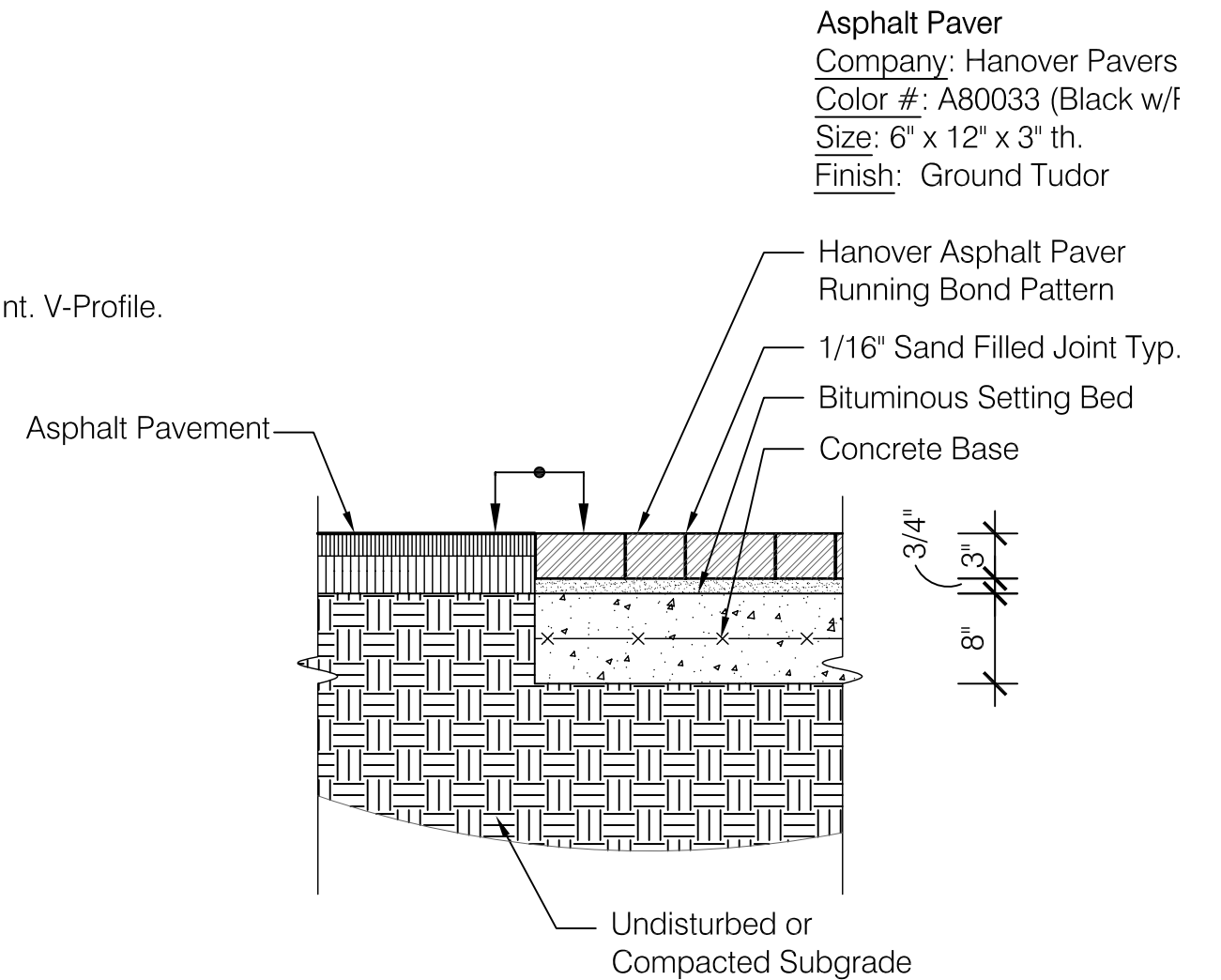
Notes:

1. Triangle Brick Company #1630 Paver (or equal) typical, concrete pavers may be approved as an alternative
2. 1/4" per foot slope to street.
3. 1 1/2" sand, compacted-mechanically compacted
4. Running course set with Portland Cement Mortar between and below or with curb



Concrete Sidewalk

Section



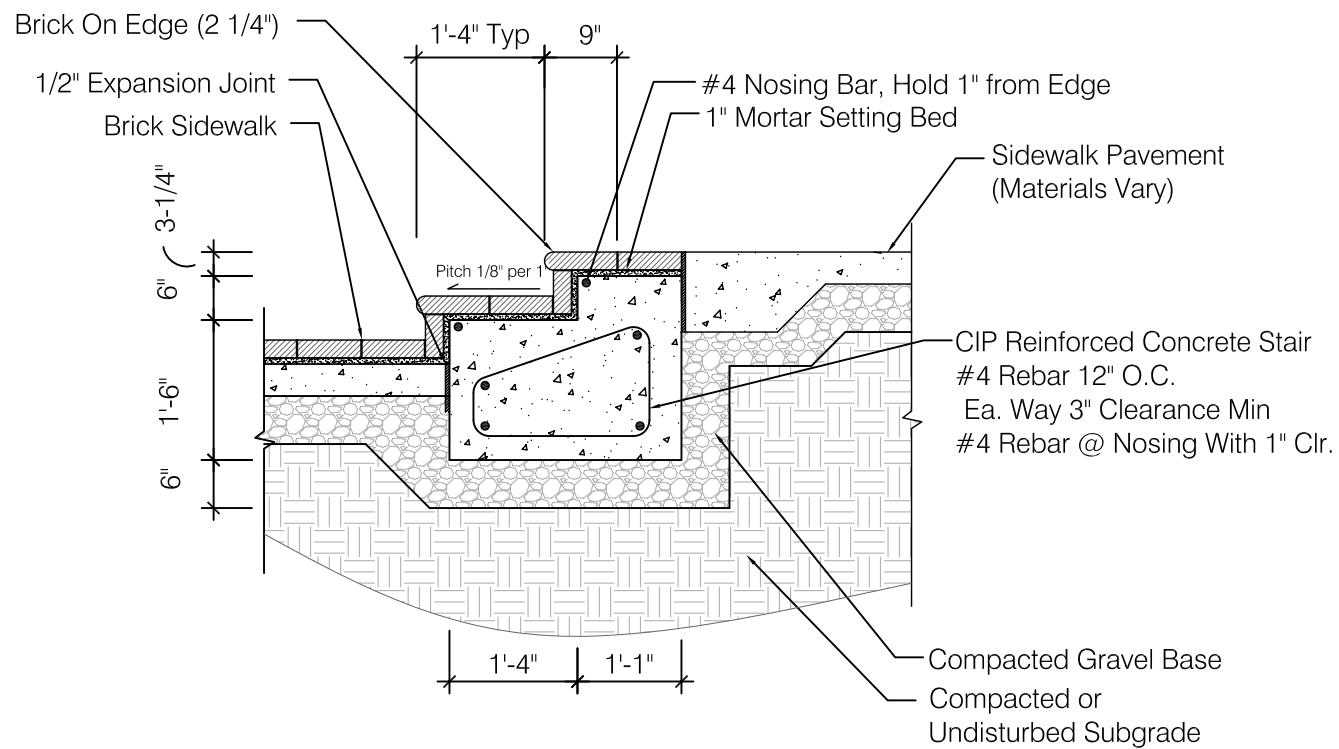
Asphalt Paver
Company: Hanover Pavers
Color #: A80033 (Black w/f
Size: 6" x 12" x 3" th.
Finish: Ground Tudor

Asphalt Paver Intersection

Section

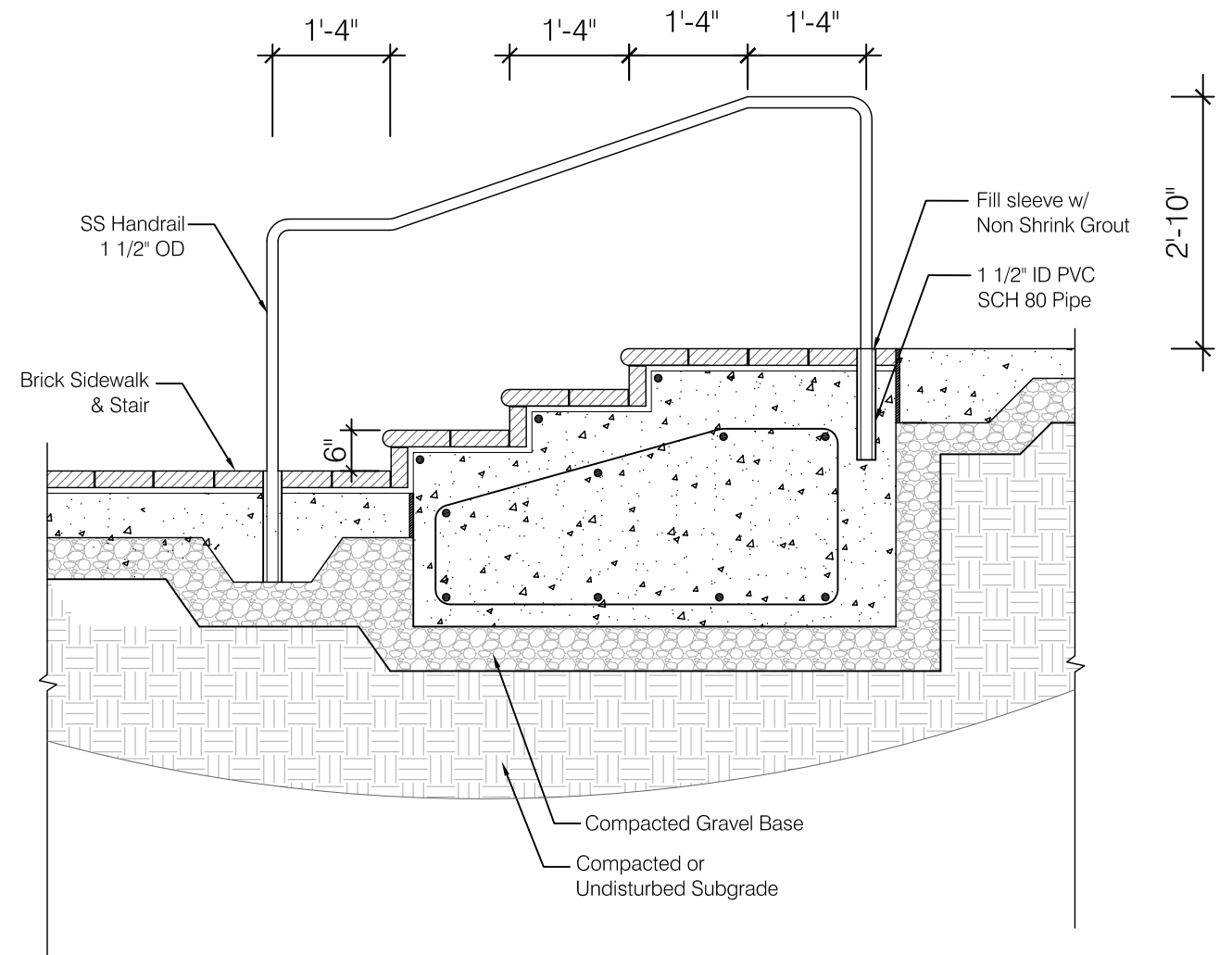
Notes:

1. Raised and flush intersection pavers shall be asphalt paver. Refer to site plan for locations.



Brick Stair

Section

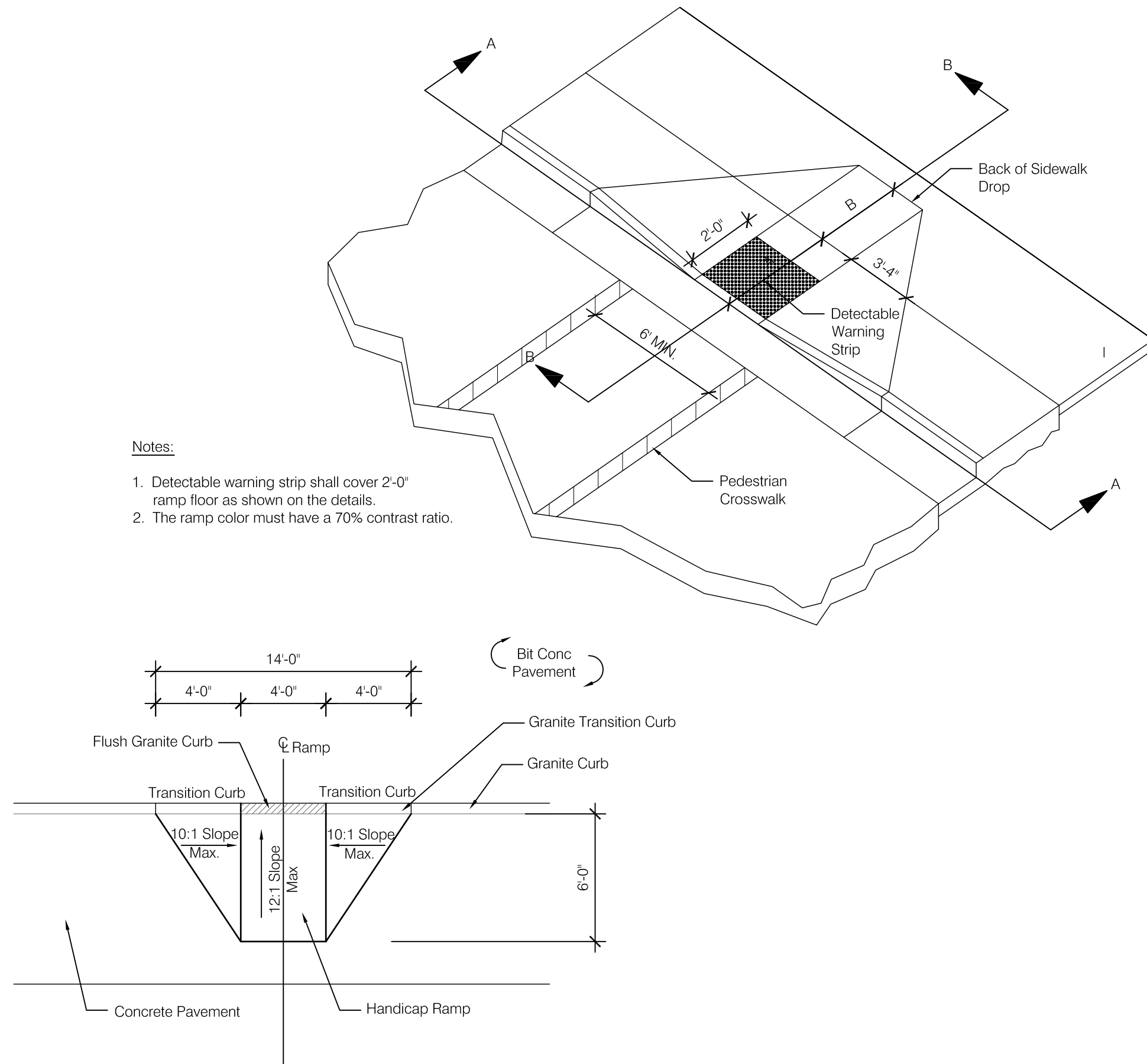


Stainless Steel Handrail

Section

Notes:

1. Handrails shall only be used if grade change exceeds two risers. Grade changes for new construction shall attempt to provide a universally accessible environment.
2. Stainless steel handrails to be finished with black oxide coating Electrochemical Products Inc. Insta-Blak SS-270.



W	A	W+A+9"	X	B
5'	0.0'	5.8'	5.8'	5.0' *
6'	0.0'	6.8'	6.8'	6.0' **
7'	0.0'	7.8'	7.3'	6.5' **
8'	0.0'	8.8'	7.3'	6.5' **
5'	2.0'	7.8'	7.8'	5.0'
5'	2.5'	8.3'	8.1'	4.8'
5'	3.0'	8.8'	8.3'	4.4'
5'	3.5'	9.3'	8.4'	4.1'
5'	4.0'	9.8'	8.6'	3.8'
5'	4.5'	10.3'	8.7'	3.4'
5'	5.0'	10.8'	8.9'	3.1'

$$B = X - (A + 9")$$

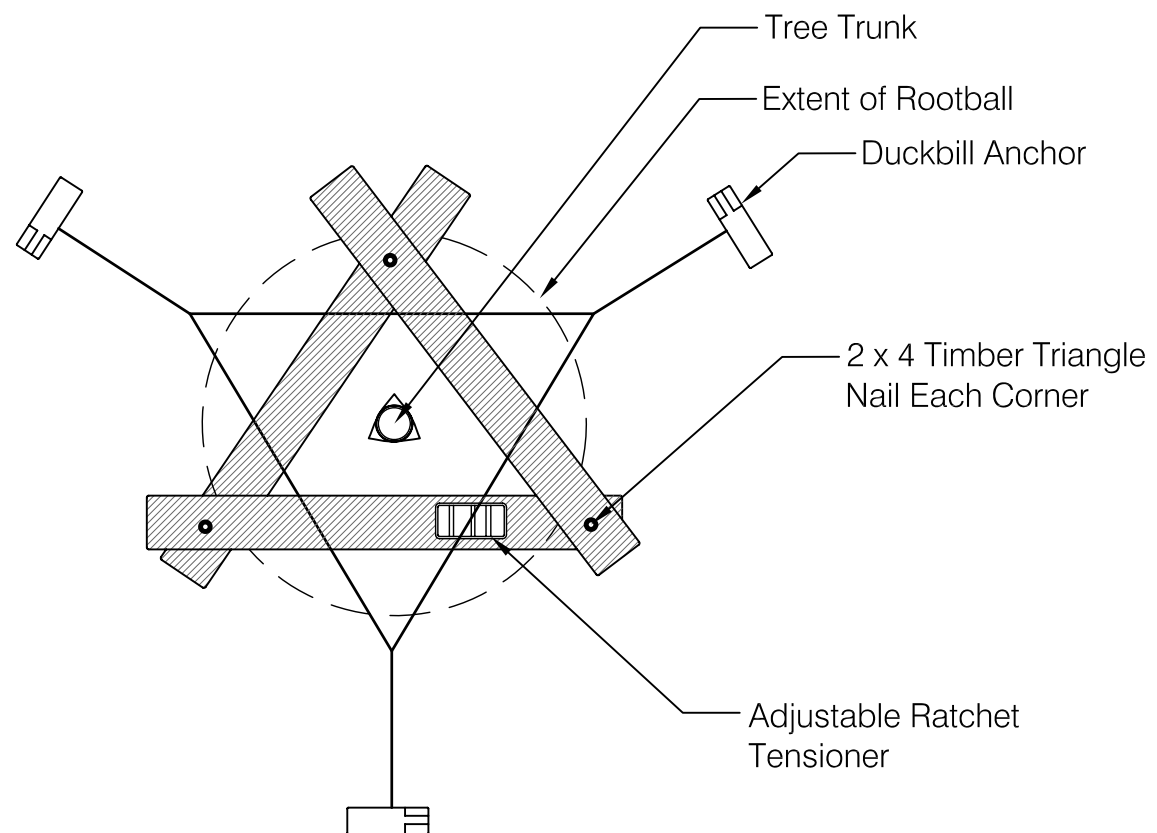
B = Distance from Front Edge of Sidewalk to Back Point of 12:1 (8.33%) Slope.

* Back of Sidewalk Drop Required for All Sidewalk Slopes.

** Back of Sidewalk Drop Required for Sidewalk Slopes 0.04.

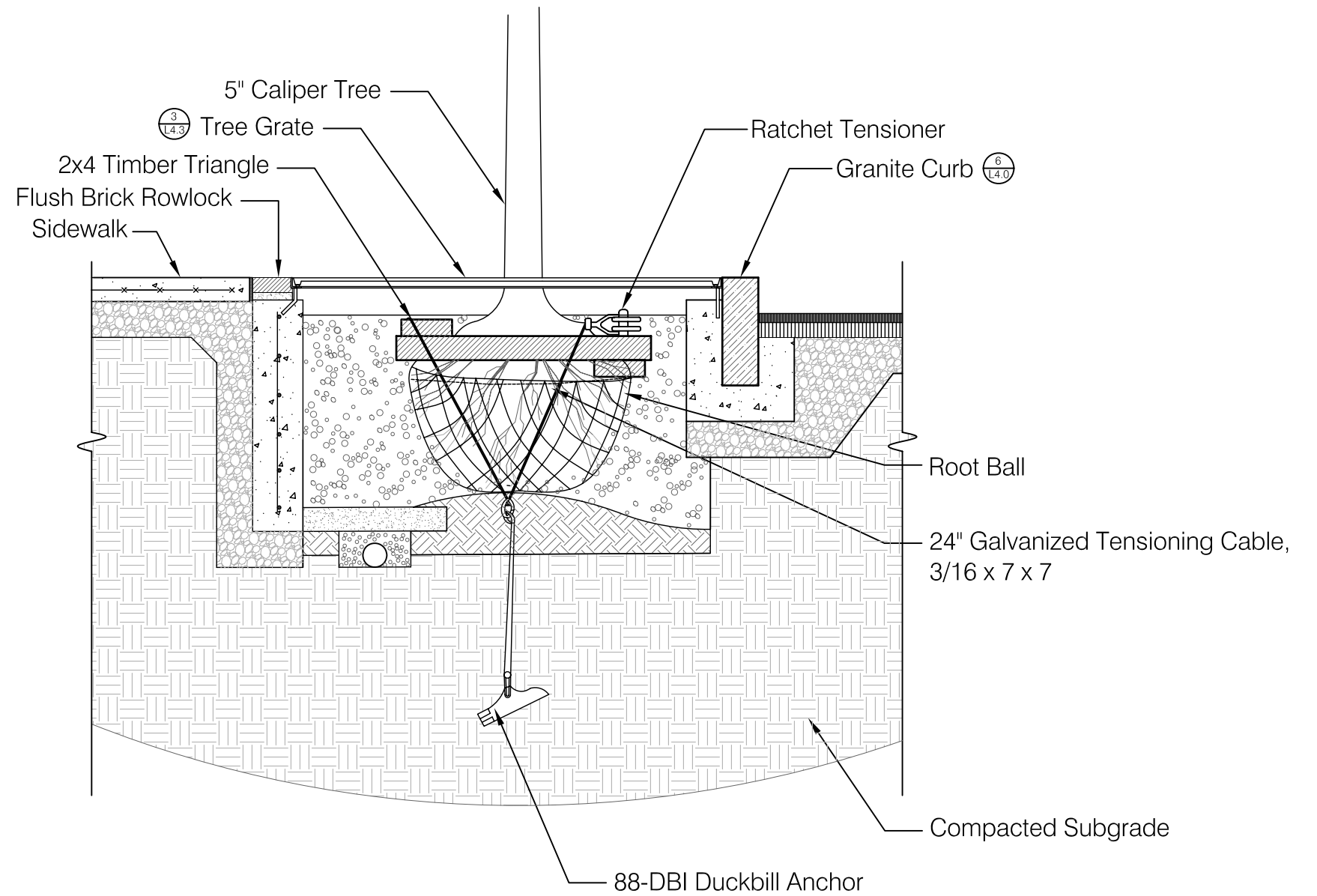
Accessible Ramp @ Curb

Plan and Isometric Diagram



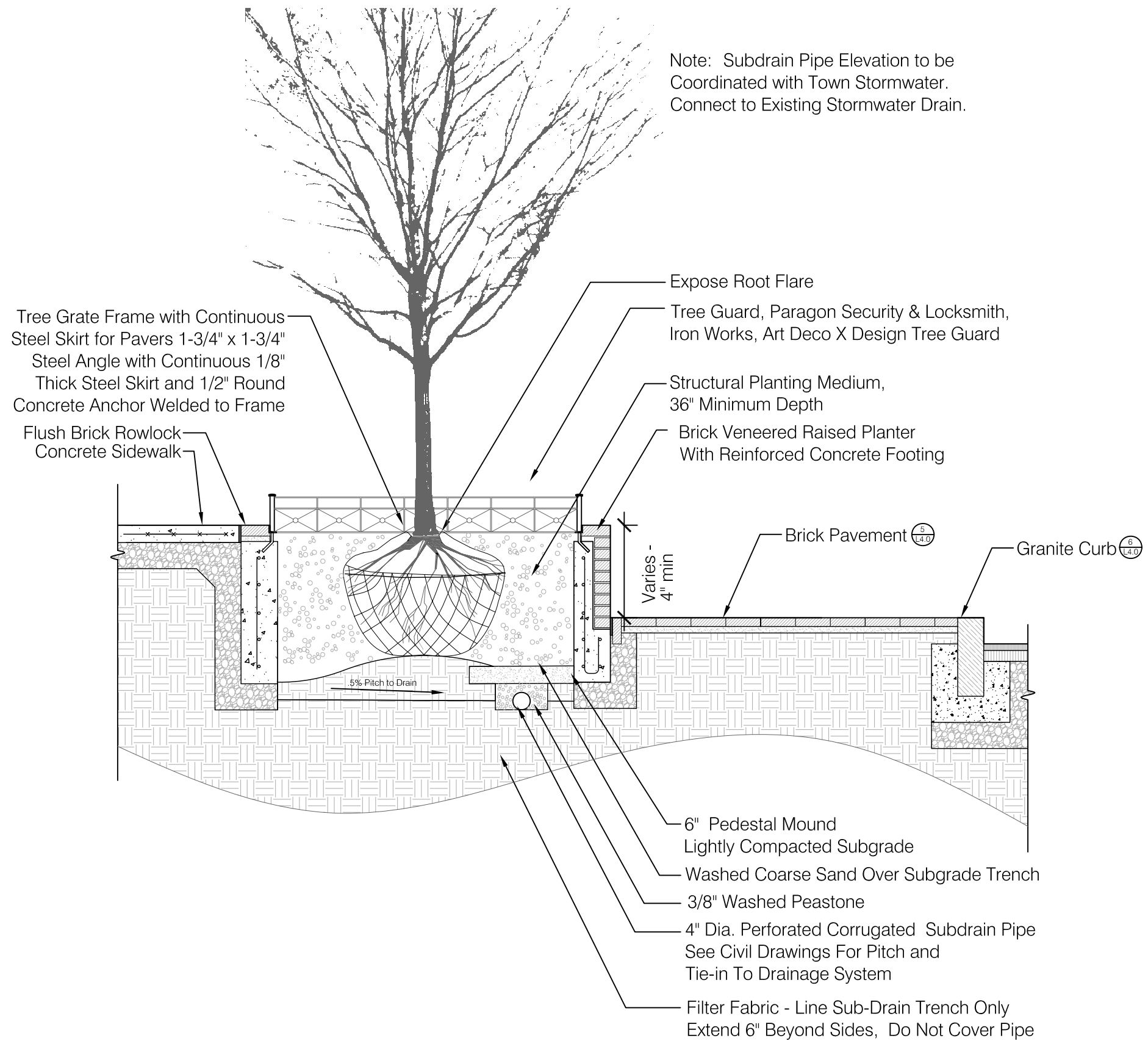
DuckBill Tree Anchor System

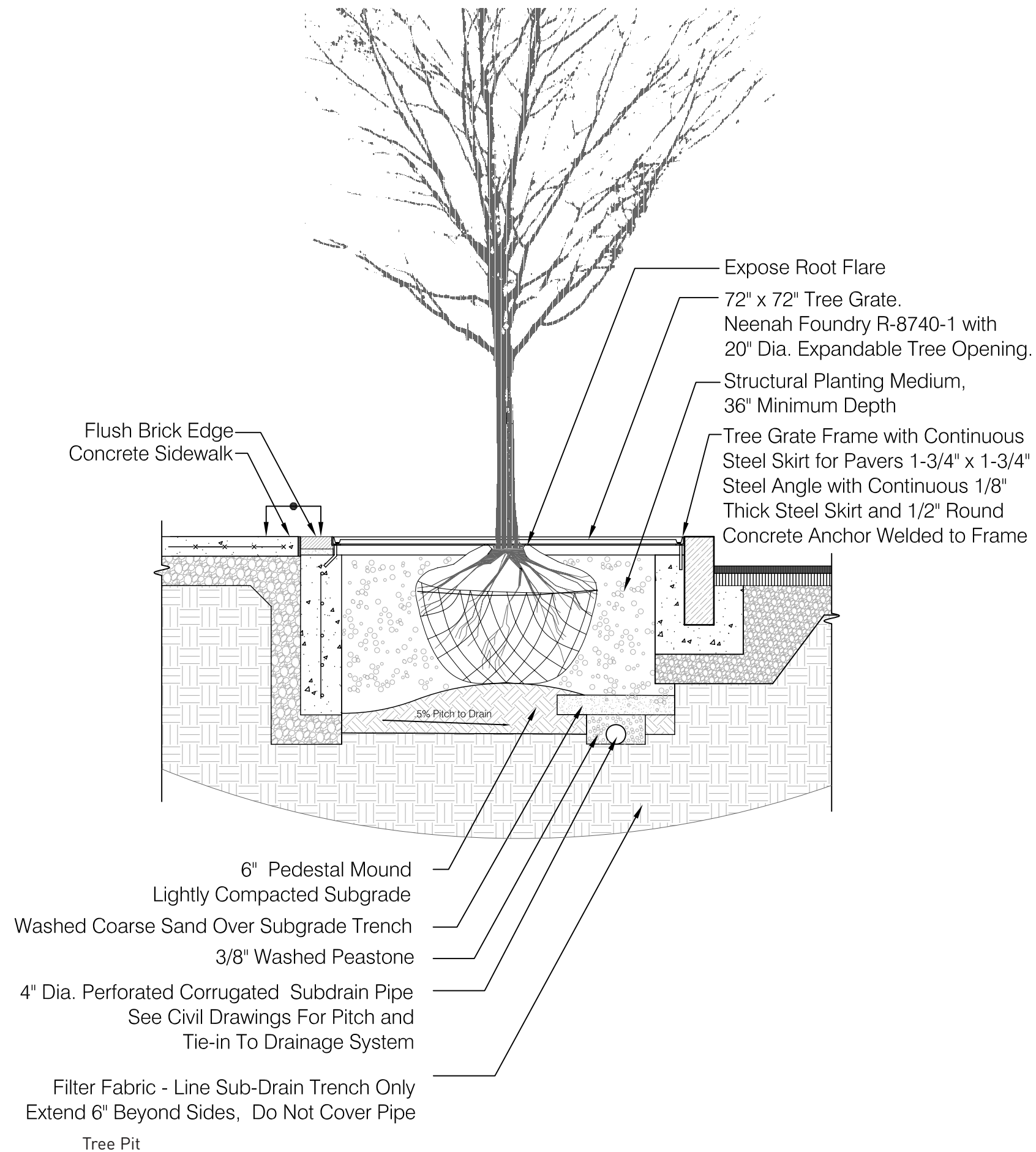
Plan



DuckBill Tree Anchor System

Section





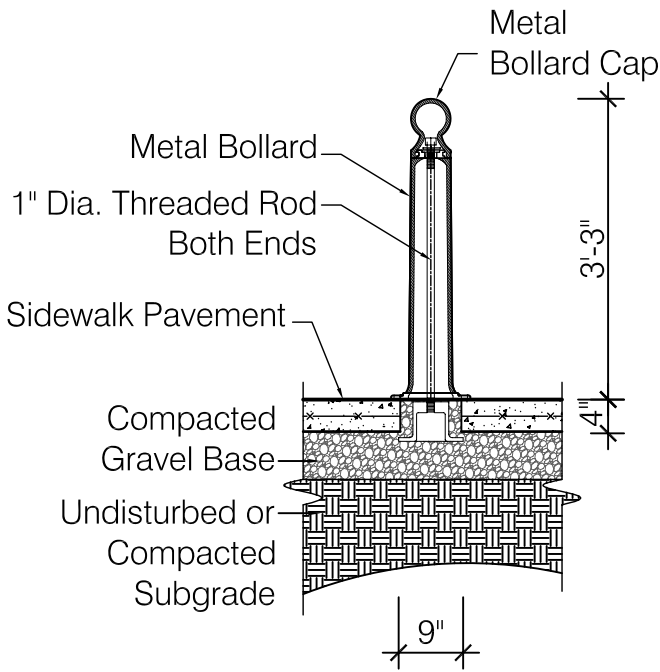
Bollard

Company: Reliance Foundry Co Ltd.

Color: Black

Model #: R7530

Note: When Existing Pavement Is To Remain And Bollards Are Required Use Model R7530 "Concrete Insert or Expoxy Into Existing Concrete"



Bollard

Section

Bike Rack

Supplier: Sunshine U-Lok Corp.

Series: Simple-Lok

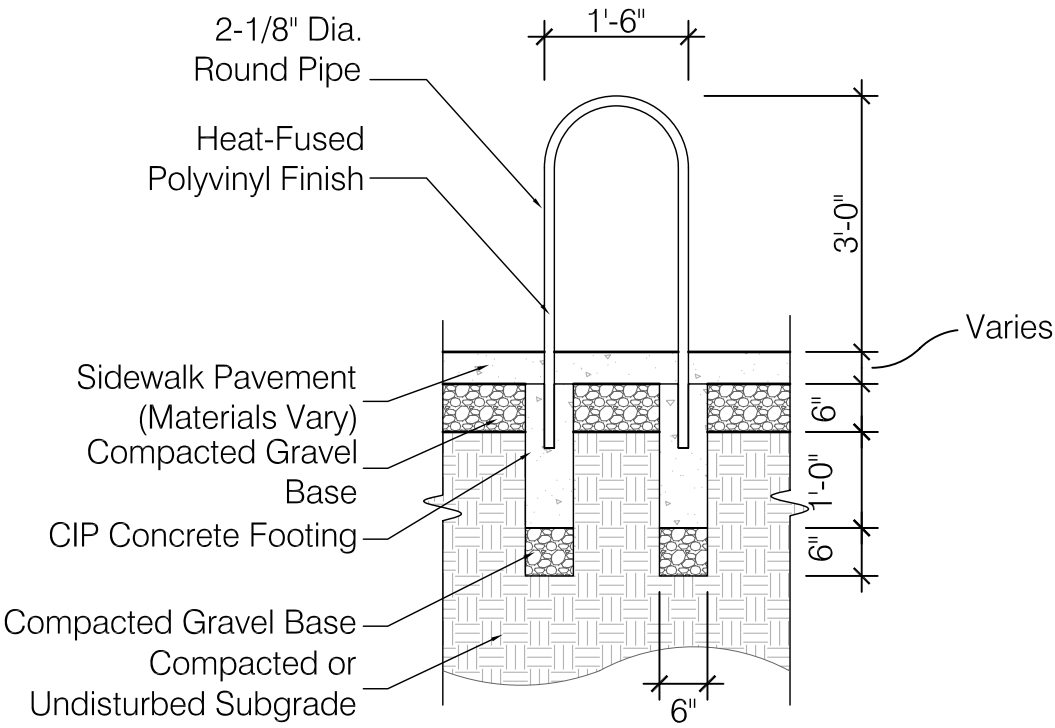
Model: Single Loop Inverted "U"

Mount: In-ground

Finish: Heat-Fused Polyvinyl

Color: Black

Website: www.sunshineu-lok.com



Bike Loop

Section

Trash Receptacle

Supplier: Hasley and Associates

Series: Victor Stanley Ironsites Series

Model: S-424 36-gallon with
standard lid

Color: Victor Stanley black

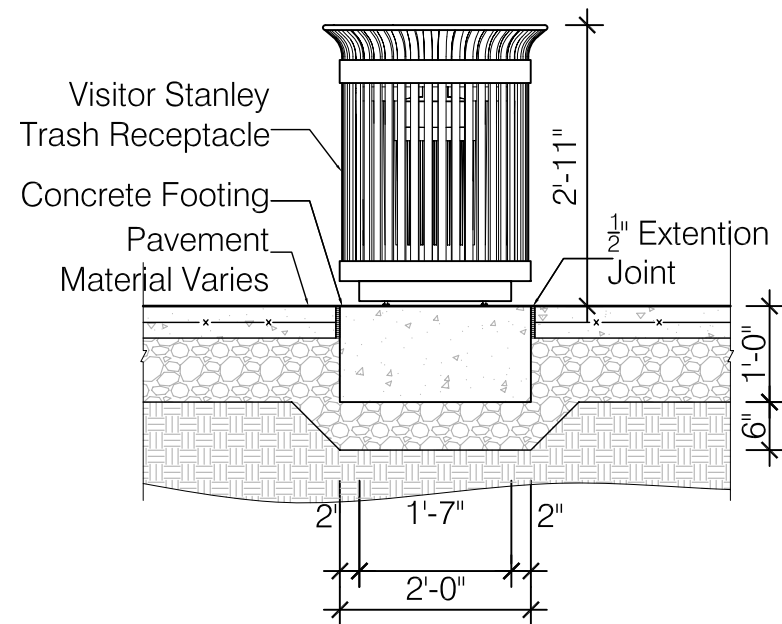
Manufacturer's representative:

Hasley and Associates

P.O.Box 79227

Charlotte, NC 28271-7062

(800) 289-4183



Trash Receptacle

Section

Recycling Receptacle

Supplier: Hasley and Associates

Series: Victor Stanley Ironsites Series

Model: DYN-236 MegaCan recycling
station and litter receptacle with two
36 gallon liners, one standard tapered
formed lid, and one recycle slotted lid

Color: Victor Stanley black

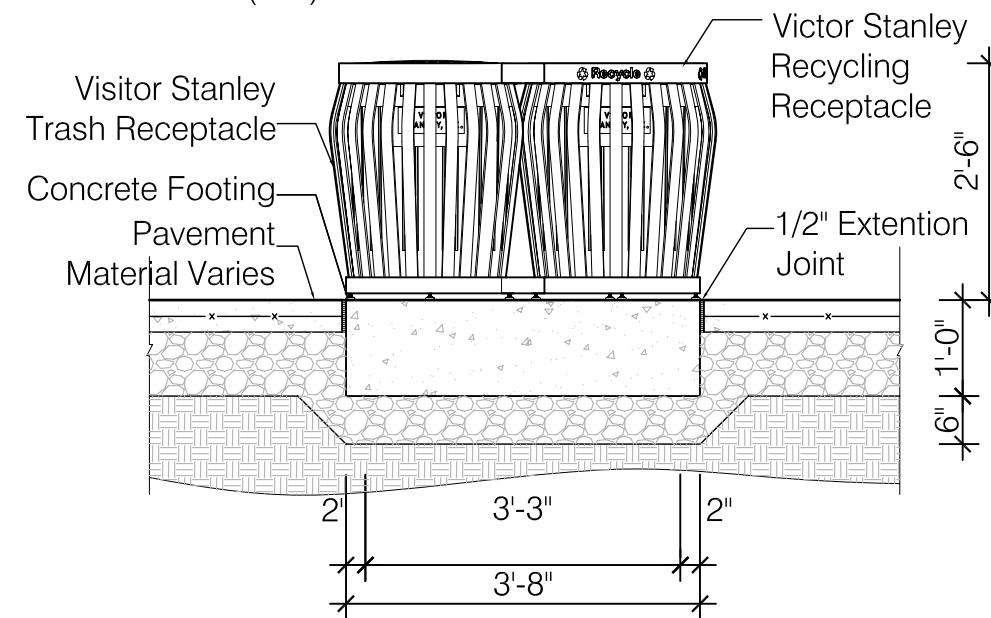
Manufacturer's representative:

Hasley and Associates

P.O.Box 79227

Charlotte, NC 28271-7062

(800) 289-4183



Recycling Receptacle

Section

Bench

Supplier: Landscape Forms

Series: Petoskey

Model: custom length 66", dual
embedded support

Color: black powder coat

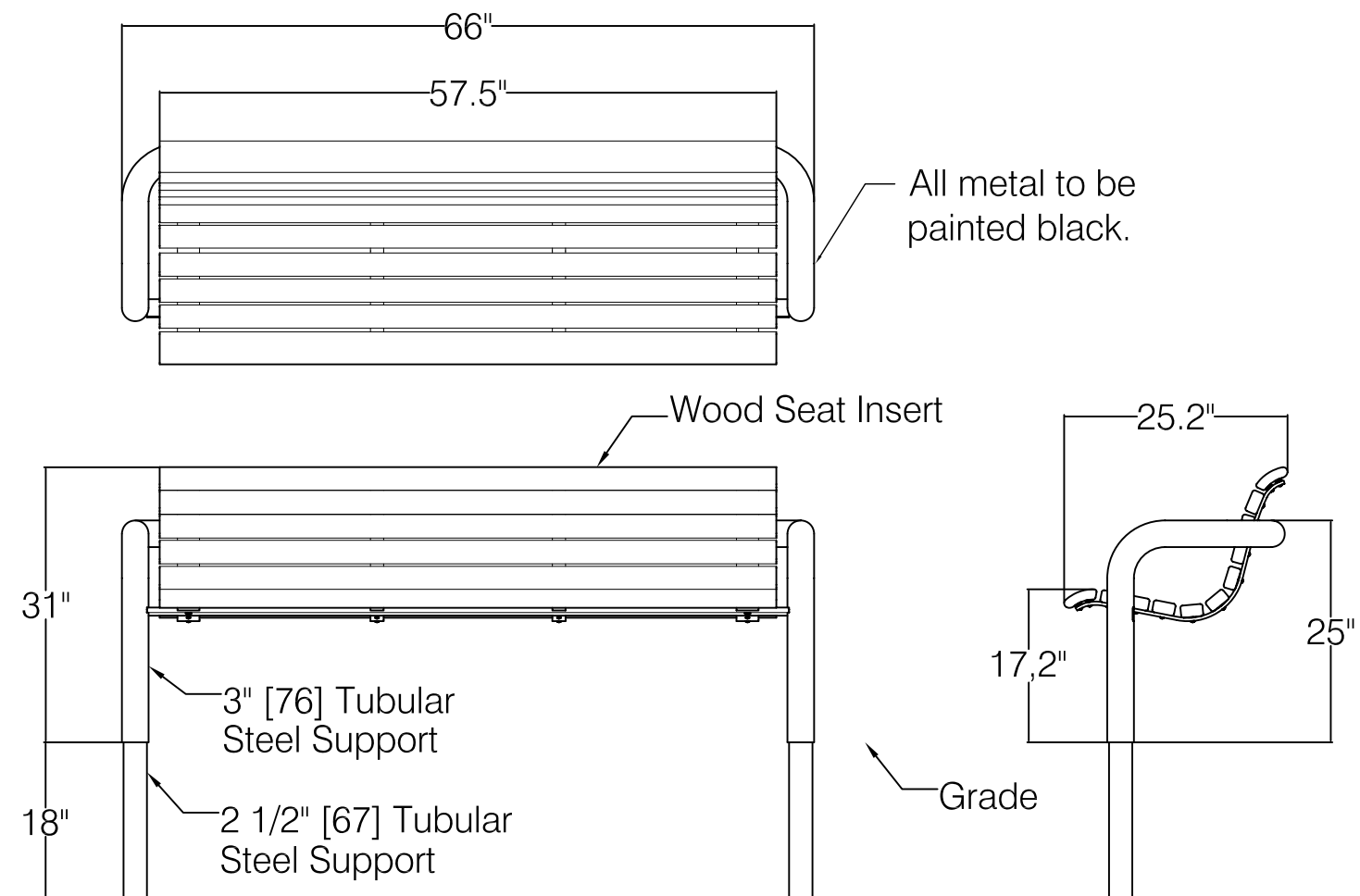
Manufacturer's representative:

Landscape Forms, Inc.

431 Lawndale

Kalamazoo, MI 49048-9543

(800) 521-2546



Franklin Street, Chapel Hill, NC Inventory and Management Plan, 2007



Inventoried & Prepared by:

Patrick Anderson, ISA Board-Certified Master Arborist

Bryan Lowrance, ISA Certified Arborist

&

Mike Sherwood, ISA Board-Certified Master Arborist

Bartlett Inventory Solutions

by



Franklin Street, Chapel Hill, NC Inventory and Management Plan
Table of Contents

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II. Executive Summary

III. Inventory Objectives

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V. Inventory Results and Recommendations

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- ii. Franklin St Trees for Evaluation
- iii. Franklin St Trees Recommended for Removal
- iv. Franklin St Pruning and Support System Installation
- v. Franklin St Crown Cleaning or Removal
- vi. Franklin St Trees Soil Management Recommendations
- vii Franklin St Pest Management Recommendations
- viii. Franklin St Infrastructure Interaction
- ix. Franklin St Conditions Observed
- x. Franklin St Entire Inventory

Technical Reports

Root Collar Disorders
Maintenance Pruning Standard
Phythophthora Canker
Monitor IPM Program
Tree Structure Evaluation

I. Introduction

The Bartlett Inventory Solutions Team was retained in the fall of 2007 to perform a tree inventory of the trees along Franklin Street in Chapel Hill, NC. The inventory included:

- Identifying the trees within the property and assigning a Tag number. Trees were not physically tagged.
- Identifying the trees’ condition, health, and vigor.
- Recommending removal and hazard evaluations of appropriate trees.
- Recommending pruning, soil management, and pest management treatments to promote tree safety, plant health, and longevity.
- Mapping the trees using GPSr hardware and GIS software.

For those trees that the client considers hazardous and representing an immediate safety concern, we recommend placing a sign, tape, or other warning device near those trees until such time as the hazard can be remedied.

The following report contains the findings and recommendations of the tree inventory. The material is presented in both digital and printed formats.

To view digital maps, install “Arc Reader 9.2” from:
<http://www.esri.com/software/arcgis/arcreader/index.html>
When the web page opens click on download now, and follow the prompts.
After Arc Reader is installed you can open the “FranklinSt.pmf” file (included on the disk) to see the information.

On the disk unzip the “FranklinSt. zip” file to your C-drive (C:\). It is important that you unzip the “FranklinSt.zip” file directly to your C-drive, or you will be unable to view the maps with ArcReader. After the file has been unzipped, navigate to C:\ FranklinSt., and open the folder. Within the folder will be the “Click here to open.pmf” file.

To view the entire spreadsheet of tree information for the site, open the FranklinSt.xls file.

To view a digital copy of the Inventory/ Management Plan, open the Franklin St Management Plan.pdf file.

II. Executive Summary

The inventoried portion of Franklin Street contains 185 landscape trees of 26 different species that were identified. The attributes that were collected include tree latitude and longitude and visual assessment of tree structure, health, and vigor.

Attribute collection for the tree inventory was conducted using a sub-meter accuracy GPSr device having an error in location not greater than 3 meters.

Most trees, 91 (49%), are in “good” condition, with 64 (34%) being in “fair” condition, 28 (15%) being in “poor” condition, and 2 being dead.

There is a variety of age classes represented with 90 trees (48%) being mature, 42 (24%) semi-mature, and 53 (28%) young.

Specific recommendations for the property over the next 3 year period include:

- Removal of 16 trees (8%) which are potential hazards or in advanced stages of decline.
- 173 trees (93%) to be pruned for safety, health, structure, and appearance. Pruning is to be in compliance with the ANSI A300Z pruning standards for arboriculture.
- Cables in 2 trees need to be installed and braces rods in 1 tree need to be installed to reduce branch and crown failure potential.
- 68 trees (37%) identified have a need for root collar excavations. Buried root collars can contribute to a number of tree health problems including: development of girdling roots, basal cankers, masking root and lower stem decay, and predisposing trees to various insect and disease pests.
- An integrated pest management program is recommended to monitor pest and disease on the landscape trees on the property. Treatments are therapeutic and preventative. Treatment timing should be based on pest life cycle.
- Tree risk assessments for 12 trees (6%) are recommended to evaluate the impact of wood decay in stems and buttress roots that show a potential for failure.

III. Inventory Objectives

The management objectives for the landscape trees along Franklin Street are:

- Manage the long-term and immediate risk associated with trees in high use areas including the use of:
 - hazard pruning
 - required removals
 - tree structure evaluations
- Maximize long-term and immediate tree health and aesthetics through:
 - integrated pest management
 - soil management
 - maintenance pruning

IV. Inventory Procedures

An inventory of the trees along Franklin Street was completed using a Trimble GeoXH GPSr hardware and ArborVue GIS software. The following attribute data was collected for the trees on site:

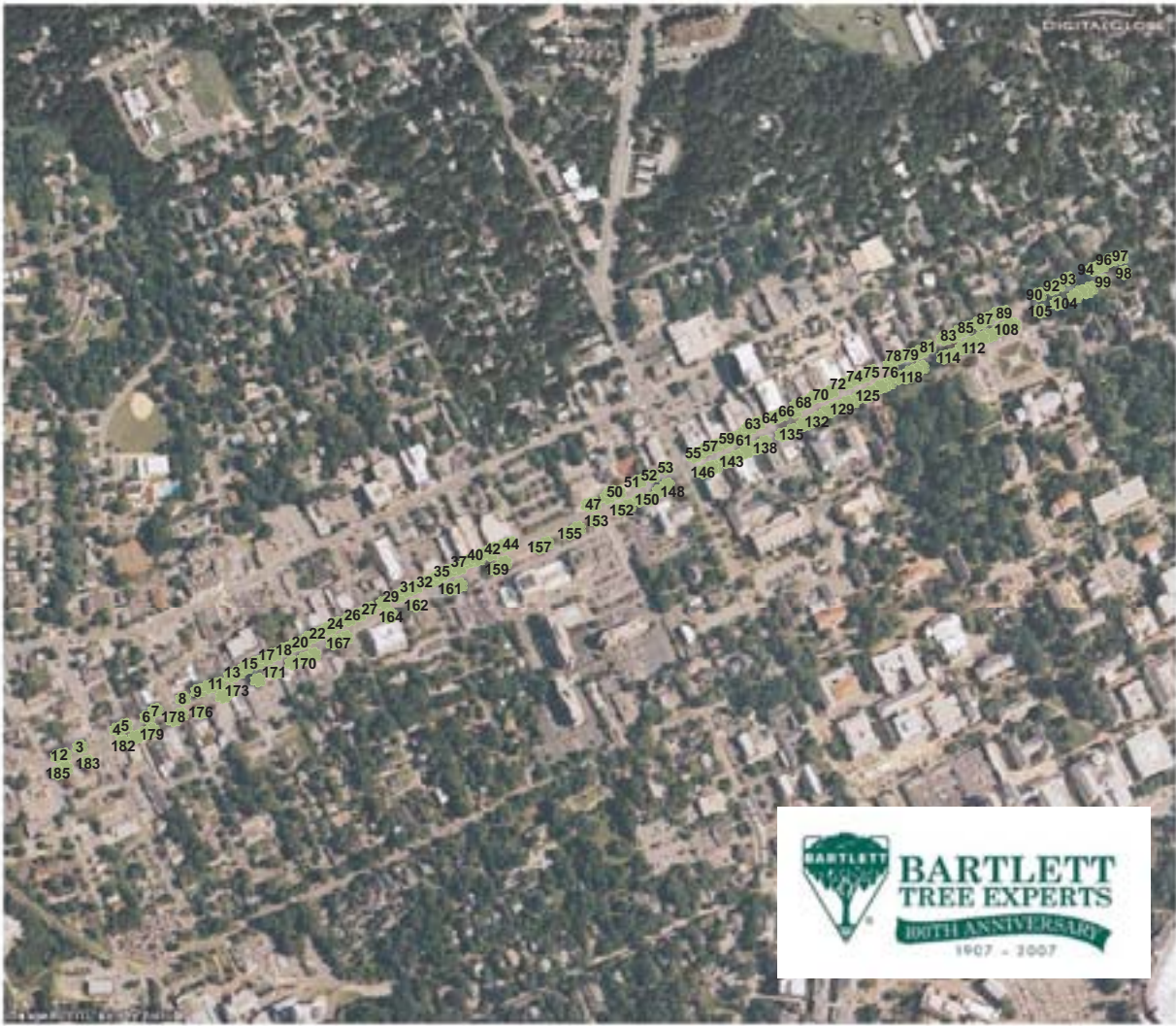
- Botanical Name/ Regional Common Name According to local ISA chapter Tree Species list.
- Tree location based on GPS coordinate system
- Tag Number
- Diameter at Breast Height (DBH)
- Canopy Radius
- Age Class
 - Young - Established tree that has not been in the landscape for many years.
 - Semi-mature - Established tree that has not yet reached full growth potential.
 - Mature - A tree within its full growth potential.
 - Over-mature - A tree that is declining or beginning to decline due to its age.
 - New Planting - A tree that is not yet established.
- Height Class
 - Small - <15'
 - Medium - 16' - 35'
 - Large - >35'

- Condition Class
 - 1 Dead
 - 2 Poor - Most of the canopy is affected with die-back, undesirable leaf color, undesirable leaf size and undesirable new growth. Tree or parts of the tree are in the process of failure.
 - 3 Fair - Parts of the canopy affected by undesirable leaf color, undesirable leaf size and undesirable new growth. Parts of the tree are likely to fail.
 - 4 Good - Tree health and condition is acceptable.
- Root Zone Infringement (Based on dripline, estimate grayscale impact on root zone)
- Infrastructure Interaction (Interaction between trees and grayscale that may cause an undesirable condition)
- Pruning
 - Clean - Selective pruning to remove one or more of the following parts: dead diseased and/or broken branches
 - Raise - Selectively pruning to provide vertical clearance
 - Thin - Selective pruning to reduce density of live branches
 - Reduce - Selective pruning to reduce height or spread
 - Structure – Selective pruning of live branches and stems to influence orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems.
- Need for or inspection of structural support systems (cables and/ or braces)
- Need for lightning protection/ inspection of lightning protection
- Tree removals
- Priority General Tree Work (Based upon a 3 year management plan)
 - Priority 1 - Trees identified that require hazard removal, crown cleaning, reduction pruning, and/ or installation of structural support systems (cables and/or braces) to reduce risk of branch failure. Reduction pruning for trees directly interfering with infrastructure, signage, or client defined objectives.
 - Priority 2 – Remedial pruning or support system installation of damaged or declining trees to maintain tree health and crown safety. Removal of trees in poor health and trees planted in unsatisfactory areas. Trees in areas not critical due to safety or property damage concerns
 - Priority 3 - Trees in good health, but require regular maintenance pruning to maintain health. Trees in areas not critical due to safety or property damage concerns
- Need for tree hazard evaluations
- Soil management recommendations
- Pest management recommendations



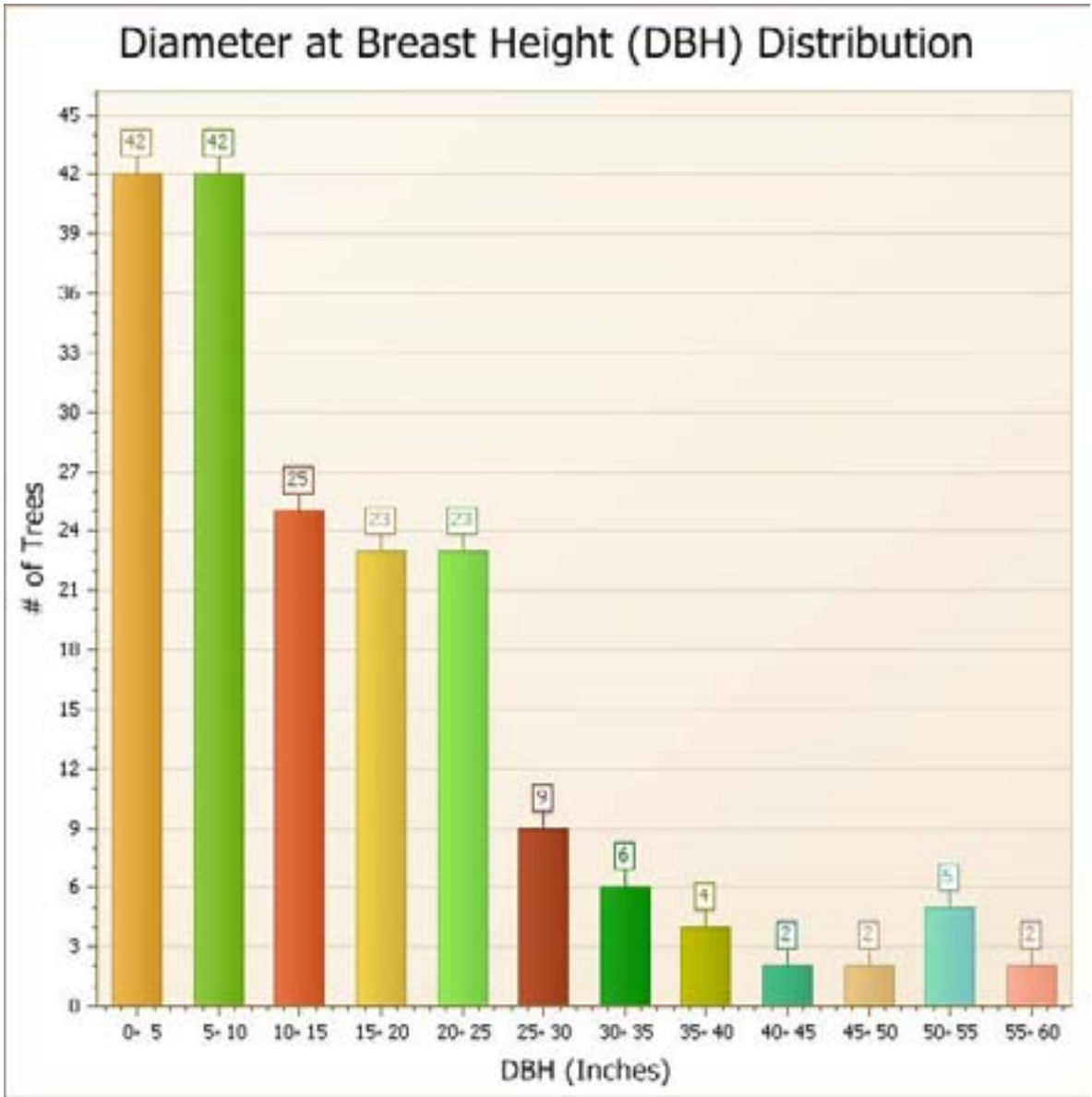
V. Inventory Results and Recommendations

Franklin Street Tree Inventory 2007



0 275 550 1,100 1,650 2,200 Feet

i. Franklin St Stand Dynamics



i. Franklin St Stand Dynamics

Common	Genus	Species	Percentage Distribution	Count
willow oak	Quercus	phellos	34.0541	63
pin oak	Quercus	palustrus	9.1892	17
crape myrtle	Lagerstroemia	indica	5.4054	10
sugar maple	Acer	saccharum	5.4054	10
American elm (non-resistant)	Ulmus	americana	4.8649	9
Chinese elm	Ulmus	parvifolia	4.8649	9
red maple	Acer	rubrum	4.8649	9
Chinese pistache	Pistacia	chinensis	4.3243	8
Northern red oak	Quercus	rubra	4.3243	8
Darlington oak	Quercus	hemispherica	2.7027	5
sawtooth oak	Quercus	accutissima	2.7027	5
Siberian elm	Ulmus	pumila	2.1622	4
callery pear Bradford	Pyrus	calleryana	1.6216	3
bald cypress	Taxodium	distichum	1.6216	3
flowering dogwood	Cornus	florida	1.6216	3
green ash	Fraxinus	pennsylvanica	1.6216	3
Japanese zelkova	Zelkova	serrata	1.6216	3
little leaf Linden	Tilia	cordata	1.6216	3
Japanese maple	Acer	palmatum	1.0811	2
Shumard oak	Quercus	shumardii	1.0811	2
eastern redcedar	Juniperus	virginiana	0.5405	1
English elm	Ulmus	procera	0.5405	1
ginkgo (male)	Ginkgo	biloba	0.5405	1
shingle oak	Quercus	imbricaria	0.5405	1
slippery elm	Ulmus	rubra	0.5405	1
water oak	Quercus	nigra	0.5405	1

ii. Franklin St Trees for Evaluation

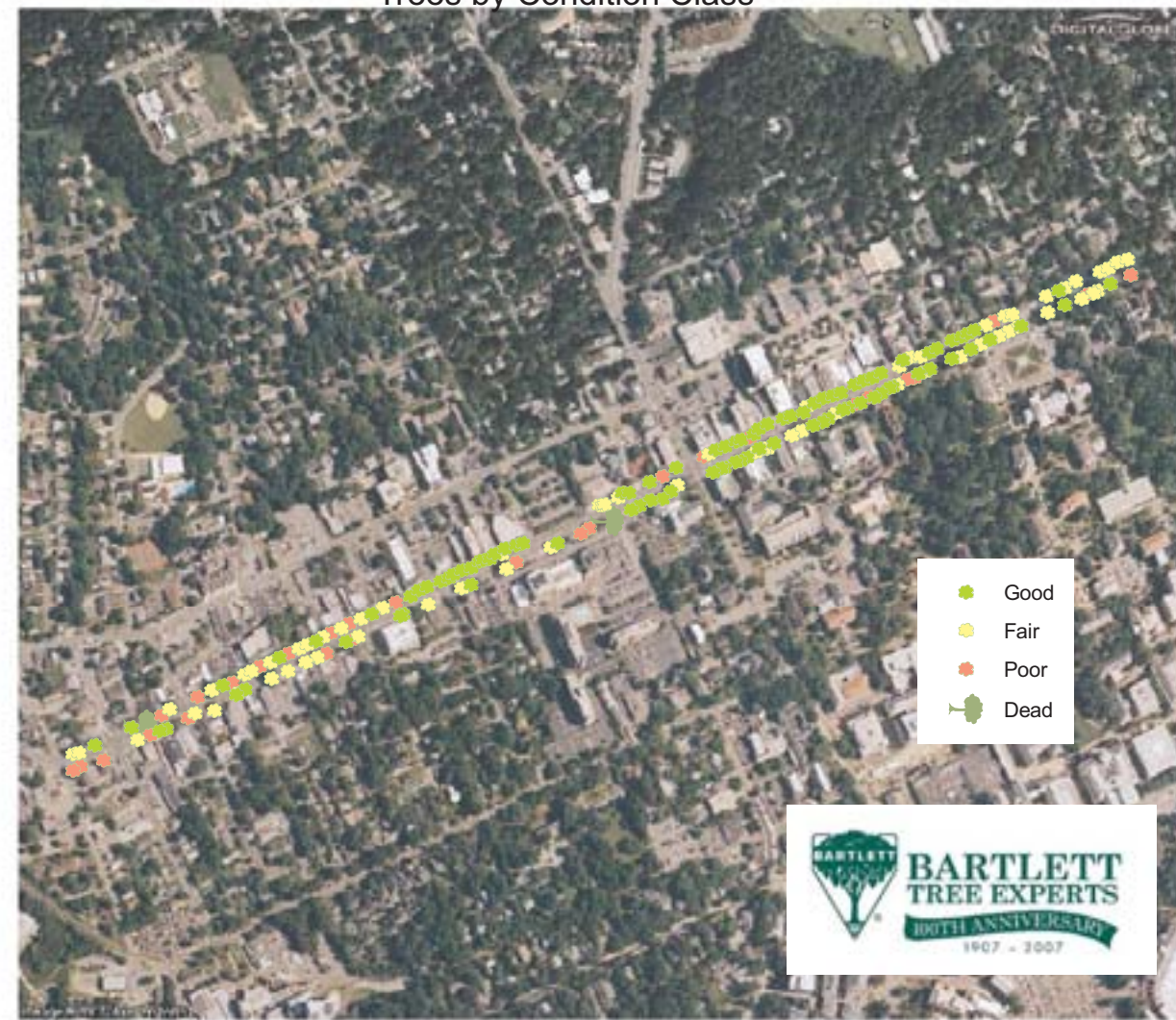
As part of this inventory, visual inspection of each tree was conducted from the ground. For the trees listed below, some aspect of tree structure or health indicated that further analysis will be necessary to more completely evaluate the condition of the tree, the risk it represents, and to make a more informed decision about the management of the tree.

Tree structure evaluations are recommended to evaluate the impact of wood decay in stems and buttress roots that show a potential for failure. Detailed tree structure evaluation may require climbing the tree, and using diagnostic tools to more thoroughly determine the nature and extent of defects and decay. It may also require detailed examination of the root system using air excavation. An experienced ISA Certified Arborist using a “tree structure drill bit” or IML resistograph (preferred method) can evaluate the amount of strength loss due to wood decay. Recommendations for tree maintenance should be made after the evaluation is complete. (Refer to *Tree Structure Evaluation* Technical Report)



Figure 1. Conk on base of Tree # 11.

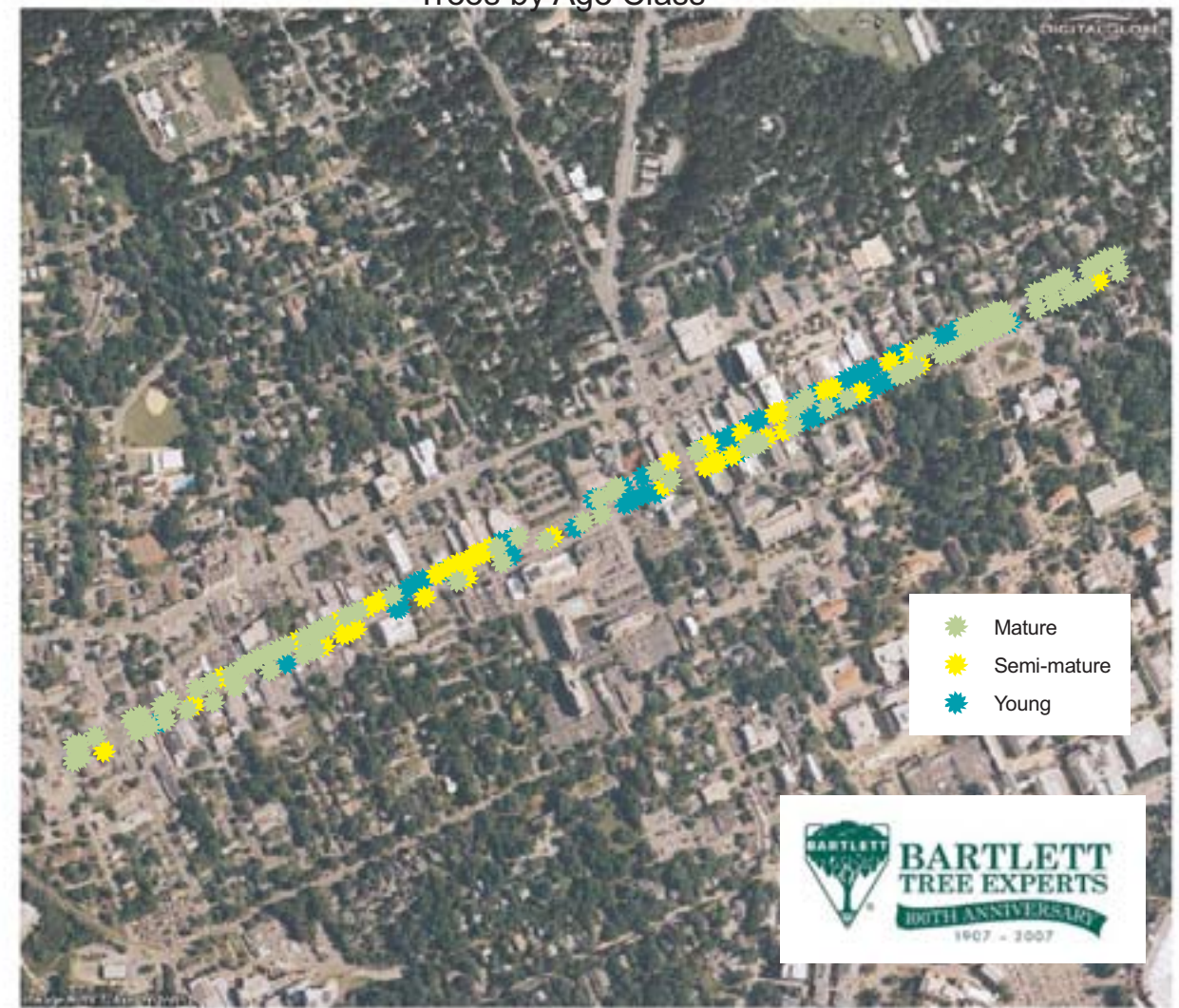
Franklin Street Tree Inventory 2007
Trees by Condition Class



0 287.5 575 1,150 1,725 2,300 Feet



Franklin Street Tree Inventory 2007
Trees by Age Class

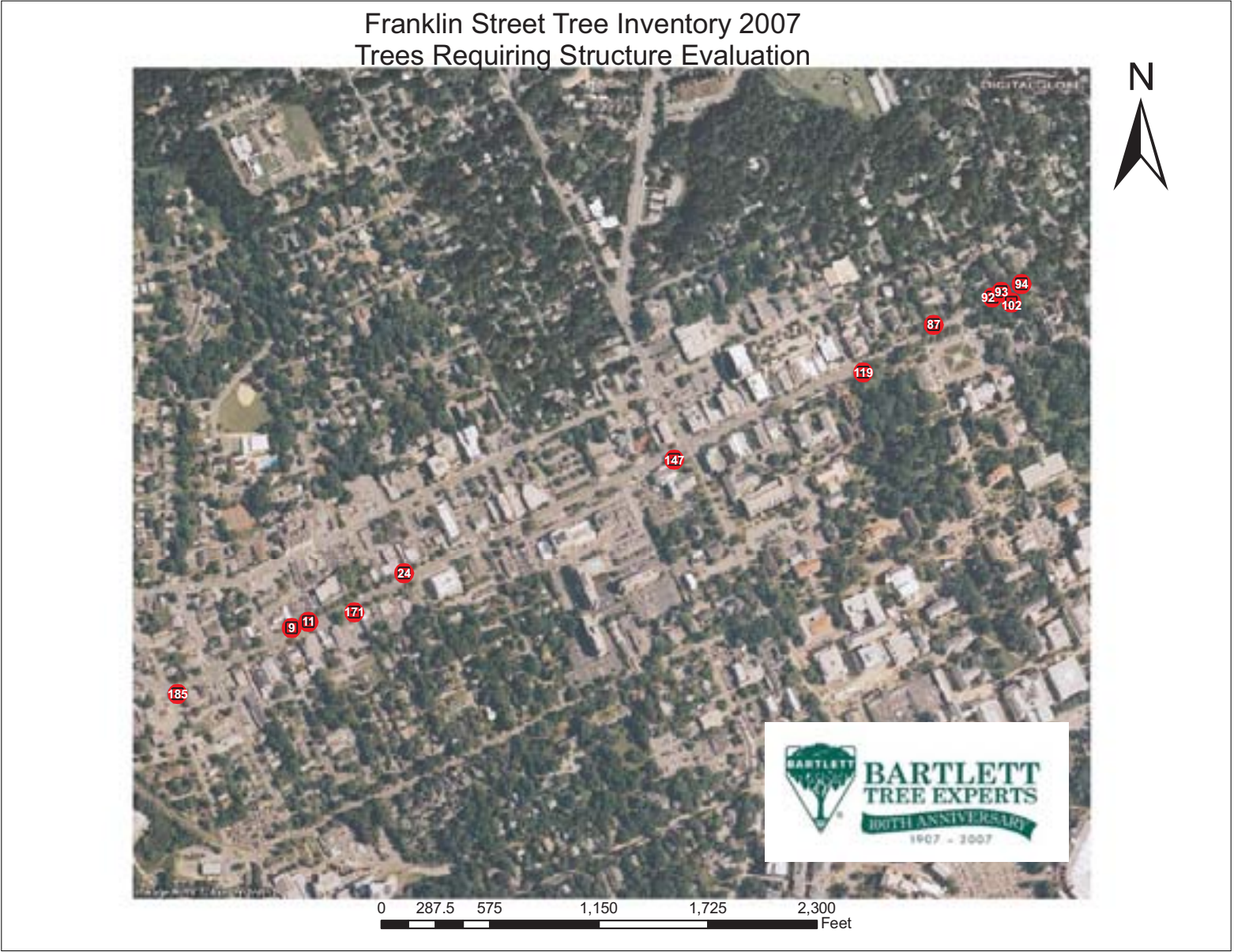


0 287.5 575 1,150 1,725 2,300 Feet



ii. Franklin St Trees for Evaluation

Tree #	Common	Diameter	Evaluation Type
9	willow oak	56	Climbing/Inspect
11	willow oak	52	Climbing/Inspect
11	willow oak	52	Drill Root Flare
24	willow oak	47	Climbing/Inspect
24	willow oak	47	Drill Stem
87	Siberian elm	26	Climbing/Inspect
92	willow oak	27	Drill Root Flare
93	willow oak	44	Drill Stem
93	willow oak	44	Climbing/Inspect
93	willow oak	44	Drill Root Flare
94	willow oak	45	Climbing/Inspect
102	Siberian elm	19	Climbing/Inspect
119	American elm (non-resistant)	33	Drill Root Flare
147	green ash	55	Drill Stem
147	green ash	55	Climbing/Inspect
171	little leaf Linden	12	Drill Stem
185	willow oak	36	Climbing/Inspect

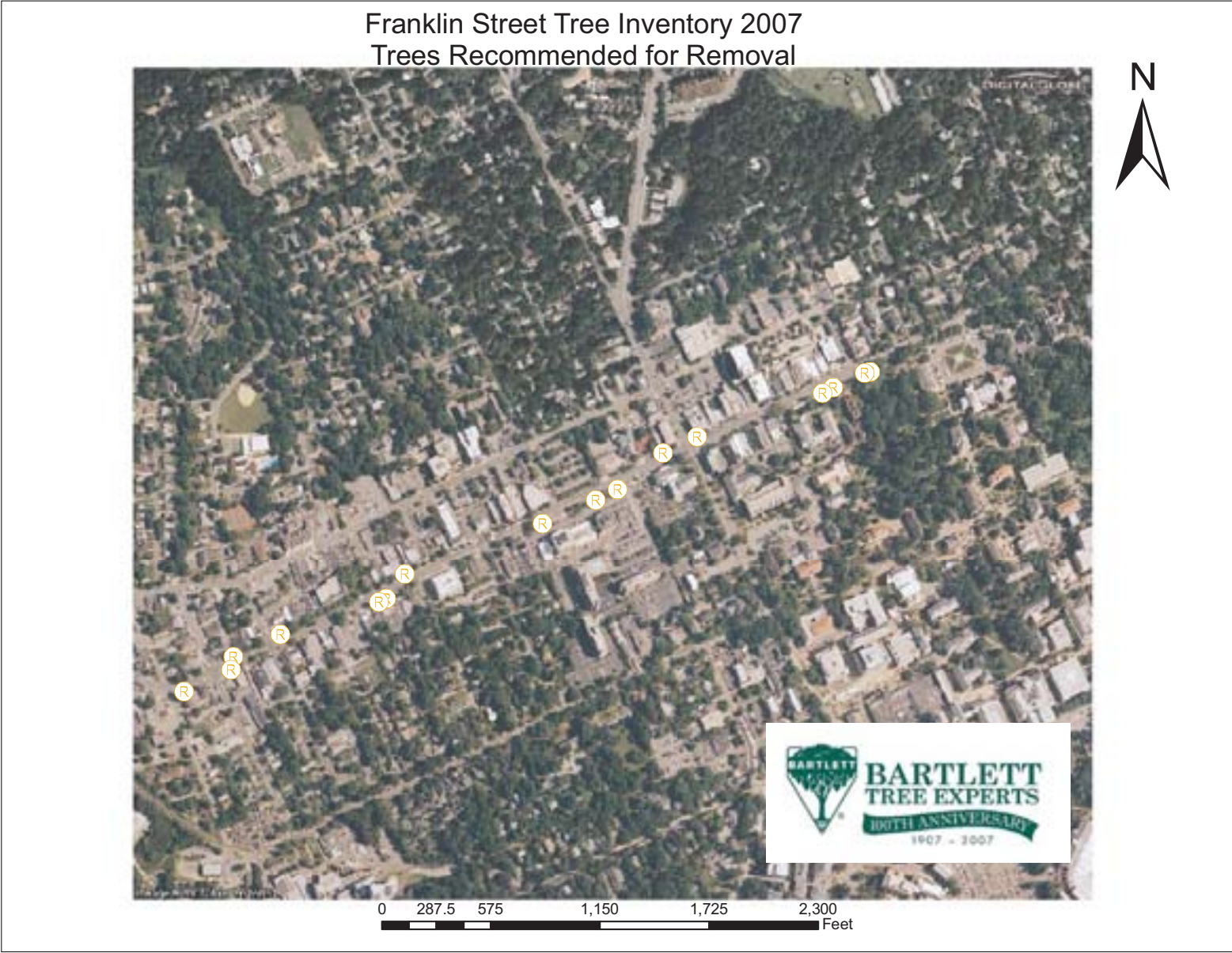


iii. Franklin St Trees Recommended for Removal by Priority

Tree #	Common	Dia	GTW Type	GTW Pri	Location
5	Siberian elm	21	REMOVAL-TAKEDOWN	1 Priority	2nd east of N Graham
52	willow oak	27	REMOVAL-TAKEDOWN	1 Priority	2nd west of N Columbia
54	green ash	11	REMOVAL-TAKEDOWN	1 Priority	1st east of N Columbia
125	red maple	16	REMOVAL-TAKEDOWN	1 Priority	22nd east of S Columbia
153	American elm (non-resistant)	20	REMOVAL-TAKEDOWN	1 Priority	7th west of S Columbia
182	callery pear Bradford	17	REMOVAL-TAKEDOWN	1 Priority	1st east of S Graham
8	willow oak	31	REMOVAL-TAKEDOWN	2 Priority	1st east of N Roberson
158	sugar maple	7	REMOVAL-TAKEDOWN	2 Priority	12th west of S Columbia
155	sugar maple	4	REMOVAL-TAKEDOWN	3 Priority	9th west of S Columbia



Figure 2. Tree # 182



iv. Franklin St Tree Pruning and Support System Installation by Priority

Acceptable Pruning Practices (Refer to *ANSI A300 (Part 1)-2001 Pruning* and Section IV *Procedures* of this document for definitions of pruning and priority):

- Clean - Selective pruning to remove one or more of the following parts: dead diseased and/or broken branches



Figure 4. Before crown clean



Figure 5. After crown clean

- Raise - Selectively pruning to provide vertical clearance



Figure 6. Before crown raise



Figure 7. Crown raise after

iv. Franklin St Tree Pruning and Support System Installation by Priority

- Thin - Selective pruning to reduce density of live branches



Figure 8. Before crown thin



Figure 9. Crown thin after

- Reduce - Selective pruning to reduce height or spread



Figure 10. Before crown reduce



Figure 11. Crown reduce after

iv. Franklin St Tree Pruning and Support System Installation by Priority

- Structure – Selective pruning of live branches and stems to influence orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems.



Figure 12. Before structure pruning



Figure 13. After structure pruning

Pruning practices that are not accepted and can yield to hazardous conditions include:

- Lion tailing – Pruning that removes interior branches along the stem and scaffold branches
- Topping – Reduction of tree’s size by using heading cuts that shorten branches to a predetermined size.



Figure 14. Lion tailed tree (unacceptable pruning practice)



Figure 15. Topped tree (unacceptable pruning practice)

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
6	slippery elm	18	CLEAN	1 Priority
6	slippery elm	18	REDUCE	1 Priority
9	willow oak	56	CLEAN	1 Priority
9	willow oak	56	REDUCE	1 Priority
11	willow oak	52	CLEAN	1 Priority
11	willow oak	52	REDUCE	1 Priority
12	willow oak	21	CLEAN	1 Priority
12	willow oak	21	REDUCE	1 Priority
13	willow oak	22	CLEAN	1 Priority
13	willow oak	22	REDUCE	1 Priority
14	willow oak	25	CLEAN	1 Priority
14	willow oak	25	REDUCE	1 Priority
15	willow oak	21	CLEAN	1 Priority
15	willow oak	21	REDUCE	1 Priority
16	willow oak	22	CLEAN	1 Priority
16	willow oak	22	REDUCE	1 Priority
17	willow oak	35	CLEAN	1 Priority
17	willow oak	35	REDUCE	1 Priority
19	willow oak	25	CLEAN	1 Priority
19	willow oak	25	REDUCE	1 Priority
20	willow oak	19	CLEAN	1 Priority
20	willow oak	19	REDUCE	1 Priority
22	Northern red oak	25	CLEAN	1 Priority
22	Northern red oak	25	REDUCE	1 Priority
23	sawtooth oak	13	CLEAN	1 Priority
23	sawtooth oak	13	REDUCE	1 Priority
24	willow oak	47	REDUCE	1 Priority
27	willow oak	13	CLEAN	1 Priority
27	willow oak	13	RAISE	1 Priority
27	willow oak	13	REDUCE	1 Priority
28	willow oak	25	CLEAN	1 Priority
28	willow oak	25	REDUCE	1 Priority
41	willow oak	22	CLEAN	1 Priority
41	willow oak	22	REDUCE	1 Priority
60	sugar maple	10	CLEAN	1 Priority
60	sugar maple	10	REDUCE	1 Priority
68	Chinese pistache	8	CLEAN	1 Priority
68	Chinese pistache	8	REDUCE	1 Priority
86	willow oak	54	CLEAN	1 Priority
87	Siberian elm	26	CLEAN	1 Priority
90	American elm (non-resistant)	40	CLEAN	1 Priority
91	willow oak	32	CABLE - NEW	1 Priority
91	willow oak	32	CLEAN	1 Priority
92	willow oak	27	CLEAN	1 Priority
93	willow oak	44	CLEAN	1 Priority
94	willow oak	45	CLEAN	1 Priority
95	willow oak	46	CLEAN	1 Priority
95	willow oak	46	RAISE	1 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
96	willow oak	56	CLEAN	1 Priority
96	willow oak	56	REDUCE	1 Priority
97	willow oak	55	CLEAN	1 Priority
97	willow oak	55	REDUCE	1 Priority
98	American elm (non-resistant)	19	CLEAN	1 Priority
99	sugar maple	9	CLEAN	1 Priority
99	sugar maple	9	REDUCE	1 Priority
102	Siberian elm	19	CLEAN	1 Priority
103	red maple	14	CLEAN	1 Priority
104	willow oak	37	CLEAN	1 Priority
104	willow oak	37	REDUCE	1 Priority
105	willow oak	35	CLEAN	1 Priority
105	willow oak	35	REDUCE	1 Priority
108	willow oak	24	CLEAN	1 Priority
109	willow oak	21	CLEAN	1 Priority
112	willow oak	24	CLEAN	1 Priority
112	willow oak	24	REDUCE	1 Priority
113	willow oak	29	CLEAN	1 Priority
114	willow oak	28	CLEAN	1 Priority
116	American elm (non-resistant)	36	CLEAN	1 Priority
130	red maple	15	CLEAN	1 Priority
134	American elm (non-resistant)	28	CLEAN	1 Priority
134	American elm (non-resistant)	28	REDUCE	1 Priority
140	sugar maple	14	CLEAN	1 Priority
140	sugar maple	14	REDUCE	1 Priority
147	green ash	55	CLEAN	1 Priority
154	American elm (non-resistant)	19	CLEAN	1 Priority
156	willow oak	13	CLEAN	1 Priority
156	willow oak	13	REDUCE	1 Priority
159	American elm (non-resistant)	28	CLEAN	1 Priority
159	American elm (non-resistant)	28	REDUCE	1 Priority
161	willow oak	25	CLEAN	1 Priority
161	willow oak	25	REDUCE	1 Priority
170	willow oak	25	CLEAN	1 Priority
170	willow oak	25	REDUCE	1 Priority
171	little leaf Linden	12	CLEAN	1 Priority
176	little leaf Linden	23	CLEAN	1 Priority
176	little leaf Linden	23	REDUCE	1 Priority
178	sawtooth oak	17	CLEAN	1 Priority
178	sawtooth oak	17	REDUCE	1 Priority
181	pin oak	18	CLEAN	1 Priority
181	pin oak	18	REDUCE	1 Priority
183	pin oak	12	CLEAN	1 Priority
183	pin oak	12	REDUCE	1 Priority
185	willow oak	36	CLEAN	1 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
185	willow oak	36	REDUCE	1 Priority
1	willow oak	26	CLEAN	2 Priority
1	willow oak	26	RAISE	2 Priority
1	willow oak	26	REDUCE	2 Priority
2	willow oak	16	CLEAN	2 Priority
2	willow oak	16	RAISE	2 Priority
2	willow oak	16	REDUCE	2 Priority
3	willow oak	19	CLEAN	2 Priority
3	willow oak	19	RAISE	2 Priority
3	willow oak	19	REDUCE	2 Priority
4	red maple	11	CLEAN	2 Priority
4	red maple	11	RAISE	2 Priority
4	red maple	11	REDUCE	2 Priority
7	willow oak	51	CABLE - NEW	2 Priority
7	willow oak	51	CLEAN	2 Priority
7	willow oak	51	REDUCE	2 Priority
18	sawtooth oak	7	CLEAN	2 Priority
18	sawtooth oak	7	REDUCE	2 Priority
21	willow oak	23	CLEAN	2 Priority
21	willow oak	23	REDUCE	2 Priority
25	willow oak	18	CLEAN	2 Priority
25	willow oak	18	REDUCE	2 Priority
26	sawtooth oak	10	CLEAN	2 Priority
26	sawtooth oak	10	REDUCE	2 Priority
37	pin oak	9	CLEAN	2 Priority
37	pin oak	9	REDUCE	2 Priority
44	willow oak	17	CLEAN	2 Priority
44	willow oak	17	REDUCE	2 Priority
47	willow oak	14	CLEAN	2 Priority
47	willow oak	14	REDUCE	2 Priority
48	callery pear Bradford	19	CLEAN	2 Priority
48	callery pear Bradford	19	RAISE	2 Priority
48	callery pear Bradford	19	REDUCE	2 Priority
49	callery pear Bradford	16	CLEAN	2 Priority
49	callery pear Bradford	16	REDUCE	2 Priority
53	Chinese elm	14	CLEAN	2 Priority
53	Chinese elm	14	REDUCE	2 Priority
64	Darlington oak	11	CLEAN	2 Priority
64	Darlington oak	11	REDUCE	2 Priority
66	Chinese elm	11	CLEAN	2 Priority
66	Chinese elm	11	REDUCE	2 Priority
85	willow oak	21	CLEAN	2 Priority
85	willow oak	21	REDUCE	2 Priority
88	red maple	14	CLEAN	2 Priority
88	red maple	14	REDUCE	2 Priority
89	English elm	15	CLEAN	2 Priority
89	English elm	15	REDUCE	2 Priority
100	Siberian elm	25	CLEAN	2 Priority
107	willow oak	24	CLEAN	2 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
110	willow oak	19	CLEAN	2 Priority
111	willow oak	17	CLEAN	2 Priority
111	willow oak	17	REDUCE	2 Priority
117	willow oak	15	CLEAN	2 Priority
135	sugar maple	13	CLEAN	2 Priority
135	sugar maple	13	REDUCE	2 Priority
136	Chinese elm	12	CLEAN	2 Priority
136	Chinese elm	12	REDUCE	2 Priority
137	flowering dogwood	7	CLEAN	2 Priority
137	flowering dogwood	7	REDUCE	2 Priority
142	Chinese pistache	9	CLEAN	2 Priority
142	Chinese pistache	9	REDUCE	2 Priority
157	red maple	10	CLEAN	2 Priority
157	red maple	10	REDUCE	2 Priority
160	willow oak	18	CLEAN	2 Priority
160	willow oak	18	RAISE	2 Priority
160	willow oak	18	REDUCE	2 Priority
162	willow oak	16	CLEAN	2 Priority
162	willow oak	16	REDUCE	2 Priority
165	willow oak	15	CLEAN	2 Priority
165	willow oak	15	REDUCE	2 Priority
166	sugar maple	8	CLEAN	2 Priority
167	sugar maple	10	CLEAN	2 Priority
167	sugar maple	10	REDUCE	2 Priority
174	crape myrtle	5	CLEAN	2 Priority
174	crape myrtle	5	REDUCE	2 Priority
175	crape myrtle	5	CLEAN	2 Priority
175	crape myrtle	5	REDUCE	2 Priority
177	little leaf Linden	10	CLEAN	2 Priority
177	little leaf Linden	10	REDUCE	2 Priority
179	pin oak	18	CLEAN	2 Priority
179	pin oak	18	REDUCE	2 Priority
180	Chinese pistache	4	REDUCE	2 Priority
180	Chinese pistache	4	STRUCTURE	2 Priority
10	red maple	7	CLEAN	3 Priority
10	red maple	7	REDUCE	3 Priority
29	Northern red oak	8	CLEAN	3 Priority
29	Northern red oak	8	RAISE	3 Priority
30	Northern red oak	11	CLEAN	3 Priority
30	Northern red oak	11	RAISE	3 Priority
31	Northern red oak	8	CLEAN	3 Priority
31	Northern red oak	8	RAISE	3 Priority
32	crape myrtle	4	CLEAN	3 Priority
32	crape myrtle	4	RAISE	3 Priority
33	Northern red oak	8	CLEAN	3 Priority
33	Northern red oak	8	RAISE	3 Priority
34	crape myrtle	3	CLEAN	3 Priority
34	crape myrtle	3	RAISE	3 Priority
35	willow oak	15	CLEAN	3 Priority
35	willow oak	15	RAISE	3 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

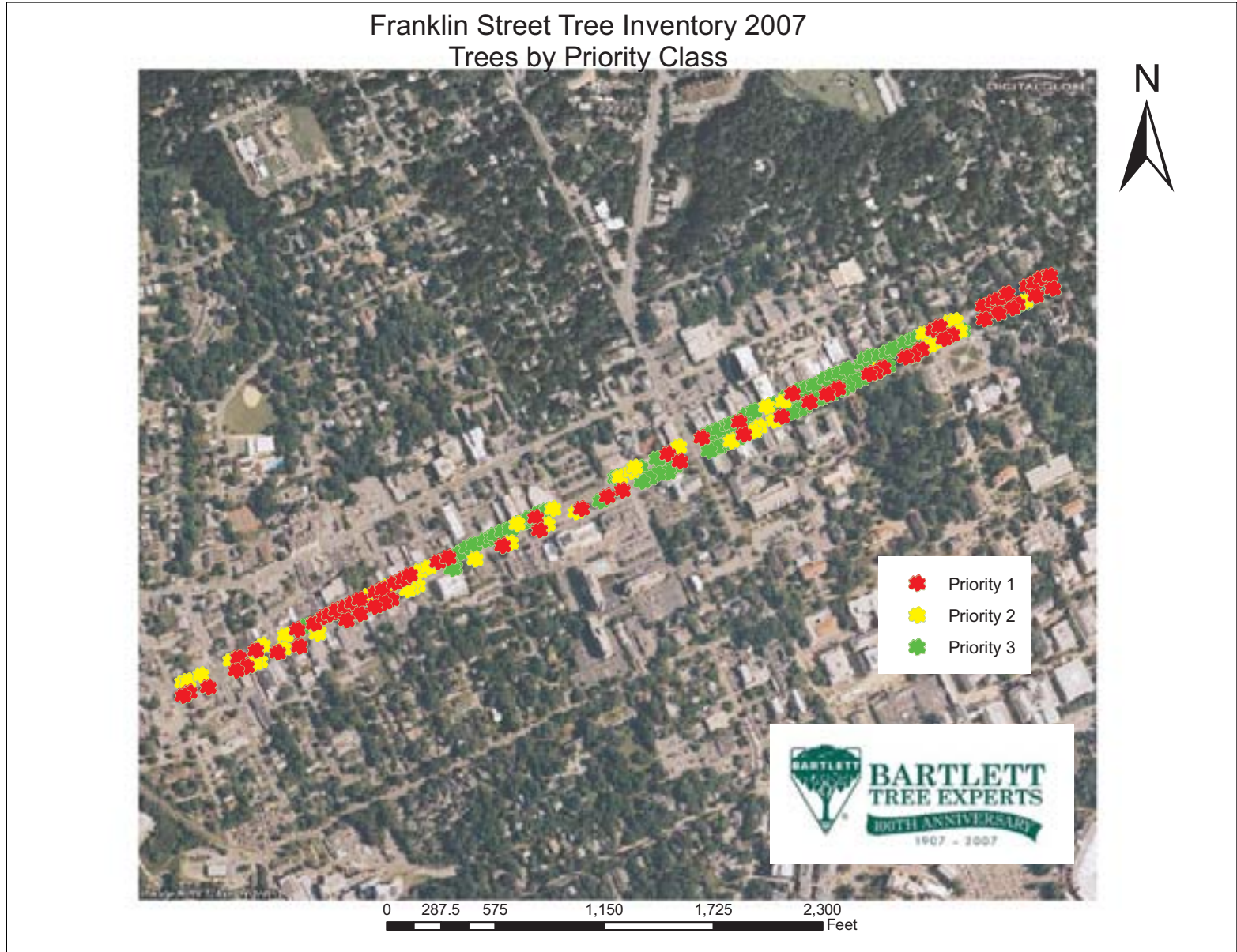
Tree #	Common	Diameter	GTW Type	GTW Priority
35	willow oak	15	REDUCE	3 Priority
36	pin oak	7	CLEAN	3 Priority
36	pin oak	7	RAISE	3 Priority
38	Japanese maple	4	CLEAN	3 Priority
38	Japanese maple	4	REDUCE	3 Priority
39	crape myrtle	5	CLEAN	3 Priority
39	crape myrtle	5	RAISE	3 Priority
40	crape myrtle	4	CLEAN	3 Priority
40	crape myrtle	4	RAISE	3 Priority
42	willow oak	9	CLEAN	3 Priority
42	willow oak	9	REDUCE	3 Priority
43	willow oak	9	CLEAN	3 Priority
43	willow oak	9	RAISE	3 Priority
43	willow oak	9	REDUCE	3 Priority
45	crape myrtle	2	CLEAN	3 Priority
45	crape myrtle	2	RAISE	3 Priority
46	crape myrtle	3	CLEAN	3 Priority
46	crape myrtle	3	REDUCE	3 Priority
50	pin oak	4	CLEAN	3 Priority
50	pin oak	4	RAISE	3 Priority
50	pin oak	4	REDUCE	3 Priority
51	Northern red oak	7	CLEAN	3 Priority
51	Northern red oak	7	RAISE	3 Priority
55	Japanese zelkova	3	CLEAN	3 Priority
56	bald cyress	7	CLEAN	3 Priority
56	bald cypress	7	REDUCE	3 Priority
57	Japanese zelkova	7	CLEAN	3 Priority
57	Japanese zelkova	7	REDUCE	3 Priority
58	bald cypress	7	CLEAN	3 Priority
58	bald cypress	7	RAISE	3 Priority
58	bald cypress	7	REDUCE	3 Priority
59	Japanese zelkova	5	CLEAN	3 Priority
59	Japanese zelkova	5	REDUCE	3 Priority
61	bald cypress	5	CLEAN	3 Priority
61	bald cypress	5	RAISE	3 Priority
61	bald cypress	5	REDUCE	3 Priority
62	pin oak	5	CLEAN	3 Priority
62	pin oak	5	REDUCE	3 Priority
63	Chinese pistache	5	STRUCTURE	3 Priority
65	Darlington oak	11	CLEAN	3 Priority
65	Darlington oak	11	RAISE	3 Priority
65	Darlington oak	11	REDUCE	3 Priority
67	Chinese elm	5	CLEAN	3 Priority
67	Chinese elm	5	REDUCE	3 Priority
69	pin oak	7	CLEAN	3 Priority
69	pin oak	7	REDUCE	3 Priority
70	Chinese elm	9	CLEAN	3 Priority
70	Chinese elm	9	REDUCE	3 Priority
71	red maple	9	CLEAN	3 Priority
71	red maple	9	REDUCE	3 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
72	Chinese elm	4	CLEAN	3 Priority
72	Chinese elm	4	REDUCE	3 Priority
73	China berry	6	CLEAN	3 Priority
73	Chinese pistache	6	RAISE	3 Priority
73	Chinese pistache	6	REDUCE	3 Priority
74	Darlington oak	5	CLEAN	3 Priority
74	Darlington oak	5	RAISE	3 Priority
75	pin oak	6	CLEAN	3 Priority
75	pin oak	6	RAISE	3 Priority
76	sugar maple	10	CLEAN	3 Priority
76	sugar maple	10	REDUCE	3 Priority
77	water oak	9	CLEAN	3 Priority
77	water oak	9	RAISE	3 Priority
77	water oak	9	REDUCE	3 Priority
78	pin oak	7	CLEAN	3 Priority
78	pin oak	7	RAISE	3 Priority
78	pin oak	7	REDUCE	3 Priority
79	sugar maple	9	CLEAN	3 Priority
79	sugar maple	9	REDUCE	3 Priority
80	sawtooth oak	14	CLEAN	3 Priority
81	green ash	17	CLEAN	3 Priority
82	willow oak	7	CLEAN	3 Priority
82	willow oak	7	RAISE	3 Priority
83	willow oak	7	CLEAN	3 Priority
83	willow oak	7	RAISE	3 Priority
84	willow oak	5	CLEAN	3 Priority
84	willow oak	5	RAISE	3 Priority
101	eastern red cedar	21	CLEAN	3 Priority
106	willow oak	4	CLEAN	3 Priority
106	willow oak	4	RAISE	3 Priority
115	willow oak	10	CLEAN	3 Priority
115	willow oak	10	RAISE	3 Priority
120	pin oak	4	CLEAN	3 Priority
120	pin oak	4	RAISE	3 Priority
122	Darlington oak	3	CLEAN	3 Priority
122	Darlington oak	3	RAISE	3 Priority
123	China berry	3	STRUCTURE	3 Priority
124	pin oak	5	CLEAN	3 Priority
124	pin oak	5	RAISE	3 Priority
126	pin oak	4	CLEAN	3 Priority
126	pin oak	4	RAISE	3 Priority
128	Chinese pistache	3	STRUCTURE	3 Priority
129	pin oak	5	CLEAN	3 Priority
129	pin oak	5	RAISE	3 Priority
131	shingle oak	4	CLEAN	3 Priority
131	shingle oak	4	RAISE	3 Priority
132	Darlington oak	4	CLEAN	3 Priority
132	Darlington oak	4	RAISE	3 Priority
133	Chinese pistache	4	STRUCTURE	3 Priority
138	flowering dogwood	7	CLEAN	3 Priority

iv. Franklin St Tree Pruning and Support System Installation by Priority

Tree #	Common	Diameter	GTW Type	GTW Priority
138	flowering dogwood	7	REDUCE	3 Priority
139	flowering dogwood	6	CLEAN	3 Priority
139	flowering dogwood	6	REDUCE	3 Priority
141	pin oak	6	CLEAN	3 Priority
141	pin oak	6	RAISE	3 Priority
141	pin oak	6	REDUCE	3 Priority
143	pin oak	5	CLEAN	3 Priority
143	pin oak	5	REDUCE	3 Priority
144	crape myrtle	3	CLEAN	3 Priority
144	crape myrtle	3	RAISE	3 Priority
145	crape myrtle	3	CLEAN	3 Priority
145	crape myrtle	3	RAISE	3 Priority
146	Chinese elm	8	CLEAN	3 Priority
146	Chinese elm	8	RAISE	3 Priority
146	Chinese elm	8	REDUCE	3 Priority
148	pin oak	9	CLEAN	3 Priority
148	pin oak	9	RAISE	3 Priority
148	pin oak	9	REDUCE	3 Priority
149	Shumard oak	5	CLEAN	3 Priority
149	Shumard oak	5	RAISE	3 Priority
150	Northern red oak	5	CLEAN	3 Priority
150	Northern red oak	5	RAISE	3 Priority
151	Northern red oak	5	CLEAN	3 Priority
152	Shumard oak	6	CLEAN	3 Priority
152	Shumard oak	6	RAISE	3 Priority
163	Chinese elm	3	REDUCE	3 Priority
163	Chinese elm	3	STRUCTURE	3 Priority
164	Chinese elm	3	REDUCE	3 Priority
164	Chinese elm	3	STRUCTURE	3 Priority



v. Franklin St Crown Cleaning or Removal

The following trees are showing signs of decline. Trees listed as 1 Priority contain potentially hazardous deadwood. In an attempt to maintain the mature tree population along Franklin Street pruning these trees may promote health, and will improve aesthetics. However, these trees are showing signs of decline. Removal of these trees may be considered a due course of action.

Tree #	Common	Dia	GTW Type	GTW Pri	Location
24	willow oak	47	REMOVAL or CLEAN	1 Priority	17th east of N Roberson
118	American elm (non-resistant)	30	REMOVAL or CLEAN	1 Priority	20th west of Raleigh
119	American elm (non-resistant)	33	REMOVAL or CLEAN	1 Priority	21st west of Raleigh
127	red maple	14	REMOVAL or CLEAN	1 Priority	20th east of S Columbia
168	willow oak	17	REMOVAL or CLEAN	1 Priority	15th east of S Roberson
169	willow oak	21	REMOVAL or CLEAN	1 Priority	14th east of S Roberson
184	willow oak	24	REMOVAL or CLEAN	1 Priority	2nd east of S Merritt Mill



Figure 11. Tree # 24

Franklin Street Tree Inventory 2007 Trees Recommended for Crown Cleaning or Removal



vi. Franklin St Trees Recommended for Root Collar Excavation

Root collar excavations are recommended for those trees whose buttress roots are covered by excess soil or mulch. Buried root collars can contribute to a number of tree health problems including: development of girdling roots, basal cankers, and masking root and lower stem decay. (Refer to *Root Collar Disorder* Technical Report)

Soil samples are recommended to determine what nutrients may be lacking in the soil, unfavorable soil pH values, and the adequacy of soil organic matter. Following laboratory test results a prescription fertilization program can be implemented to balance soil chemistry and optimize conditions for plant growth.

Results of the soil sample taken from Franklin Street are included on the following page.



Figure 16. Example of buried root collar



Figure 17. Example of excess mulch or "mulch volcano"



Figure 18. Example of recently excavated root collar (buttress roots exposed)

Soil Analysis Report

Bartlett Tree Research Laboratories

Town of Chapel Hill

Address:

Town of Chapel Hill
Franklin Street
Chapel Hill, North Carolina 27516

Bartlett Arborist: Bryan Lowrance
Plant Species: Oak, Southern Red

SampleID: 69840
Date: 21-Dec-07

Location/ELM ID: Franklin street, #148
Fertilization Goal: Maintenance

A&L: 07-354-0525

Results

Soil pH6.8AcceptableIdeal pH range for Oak, Southern Red: 4.8 to 7.0

Nitrogen (ENR)80.0* Medium

Phosphorous (P)16.0* Low

Potassium (K)376.0Very High

Magnesium (Mg)268.0* Medium

Calcium (Ca)2692.0* Medium

Soil Organic Matter (OM)2.8 * Very Low

Nutrient Retention Capacity (CEC)9.6 High

Recommendations

Prescription Fertilization		Pounds or Gallons per 1000 sq. ft.	Kg or Liters per 100 sq. m
Nitrogen	30 - 0 - 0 gallons	0.7	2.7
	38 - 0 - 0 gallons	5.0	2.4
Phosphorus	0 - 30 - 0 gallons	0.8	3.3
Potassium	0 - 0 - 52 pounds	0.0	0.0
Gypsum	pounds	60.0	28.8
Lime	powdered	0.0	0.0
	pelletized	0.0	0.0
Sulfur	pounds	0.0	0.0
Magnesium	pounds	7.0	3.4
Iron chelate	gallons	0.0	0.0
	pounds	0.0	0.0
Manganese	gallons	0.0	0.0
	pounds	0.0	0.0
Conventional Fertilization			
Boost		25.0	101.6
Boost Granular		10.0	4.8
Organic Milorganite		25.0	12.0
Mulch or incorporate organic matter:		Yes	
Comments:			

* indicates a deficiency ** indicates a potential toxicity
*** Maximum single application limestone 75 lbs pelletized or 50 lbs powdered. Max sulfur 5 lbs on turf or 25 lbs on mulch or bare soil per 1000 sqft.

vi. Franklin St Trees Soil Management Recommendations

Tree #	Common	Diameter	RCX
6	slippery elm	18	YES
10	red maple	7	YES
18	sawtooth oak	7	YES
21	willow oak	23	YES
23	sawtooth oak	13	YES
25	willow oak	18	YES
26	sawtooth oak	10	YES
29	Northern red oak	8	YES
30	Northern red oak	11	YES
31	Northern red oak	8	YES
32	crape myrtle	4	YES
33	Northern red oak	8	YES
34	crape myrtle	3	YES
36	pin oak	7	YES
37	pin oak	9	YES
39	crape myrtle	5	YES
40	crape myrtle	4	YES
45	crape myrtle	2	YES
46	crape myrtle	3	YES
48	callery pear Bradford	19	YES
50	pin oak	4	YES
51	Northern red oak	7	YES
55	Japanese zelkova	3	YES
57	Japanese zelkova	7	YES
59	Japanese zelkova	5	YES
65	Darlington oak	11	YES
68	Chinese pistache	8	YES
73	Chinese pistache	6	YES
76	sugar maple	10	YES
77	water oak	9	YES
78	pin oak	7	YES
79	sugar maple	9	YES
80	sawtooth oak	14	YES
81	green ash	17	YES
82	willow oak	7	YES
83	willow oak	7	YES
84	willow oak	5	YES
120	pin oak	4	YES
121	Japanese maple	1	YES
122	Darlington oak	3	YES
123	Chinese pistache	3	YES
124	pin oak	5	YES
126	pin oak	4	YES
131	shingle oak	4	YES
132	Darlington oak	4	YES
133	Chinese pistache	4	YES
135	sugar maple	13	YES
136	Chinese elm	12	YES
137	flowering dogwood	7	YES
140	sugar maple	14	YES

vi. Franklin St Trees Soil Management Recommendations

Tree #	Common	Diameter	RCX
141	pin oak	6	YES
142	Chinese pistache	9	YES
143	pin oak	5	YES
145	crape myrtle	3	YES
146	Chinese elm	8	YES
149	Shumard oak	5	YES
151	Northern red oak	5	YES
152	Shumard oak	6	YES
155	sugar maple	4	YES
158	sugar maple	7	YES
163	Chinese elm	3	YES
164	Chinese elm	3	YES
171	little leaf Linden	12	YES
174	crape myrtle	5	YES
175	crape myrtle	5	YES
176	little leaf Linden	23	YES
177	little leaf Linden	10	YES
180	Chinese pistache	4	YES



vii. Franklin St Pest Management Recommendations

An Integrated Pest Management Program is recommended for the trees along Franklin Street to monitor for potentially damaging insects, diseases and cultural problems that were not evident during the course of the inventory. These pests include but are not limited to:

- Carpenter Worm – on a variety of tree species
- Ambrosia Beetle Stem Borers – on a variety tree species
- Phythophthora Bleeding Canker – on a variety of species, especially oak and maple species
- Bagworms - on a variety of tree species, especially bald cypress (observed)
- Spidermites – on a variety of trees species
- Scale Insects – on a variety of tree species
- Anthracnose – on flowering dogwood, ash, and maple species
- Dutch Elm Disease – on elm species
- Bacterial Leaf Scorch – on oak species

viii. Franklin St Infrastructure Interaction

Tree #	Common	Diameter	Interaction Type
1	willow oak	26	Overhead Lines
2	willow oak	16	Overhead Lines
3	willow oak	19	Overhead Lines
4	red maple	11	Overhead Lines
4	red maple	11	Building
5	Siberian elm	21	Building
5	Siberian elm	21	Overhead Lines
6	slippery elm	18	Overhead Lines
6	slippery elm	18	Building
7	willow oak	51	Building
7	willow oak	51	Overhead Lines
8	willow oak	31	Overhead Lines
9	willow oak	56	Overhead Lines
9	willow oak	56	Building
10	red maple	7	Building
11	willow oak	52	Building
11	willow oak	52	Overhead Lines
12	willow oak	21	Overhead Lines
12	willow oak	21	Building
13	willow oak	22	Building
13	willow oak	22	Overhead Lines
14	willow oak	25	Building
14	willow oak	25	Overhead Lines
15	willow oak	21	Overhead Lines
15	willow oak	21	Lighting
15	willow oak	21	Building
16	willow oak	22	Building
16	willow oak	22	Overhead Lines
17	willow oak	35	Overhead Lines
18	sawtooth oak	7	Overhead Lines
19	willow oak	25	Overhead Lines
20	willow oak	19	Lighting
20	willow oak	19	Building
21	willow oak	23	Building
22	Northern red oak	25	Building
22	Northern red oak	25	Lighting
23	sawtooth oak	13	Building
24	willow oak	47	Building
25	willow oak	18	Building
26	sawtooth oak	10	Building
27	willow oak	13	Lighting
28	willow oak	25	Building
33	Northern red oak	8	Lighting
35	willow oak	15	Building
37	pin oak	9	Building
41	willow oak	22	Building
41	willow oak	22	Lighting
42	willow oak	9	Building
43	willow oak	9	Building
44	willow oak	17	Building

viii. Franklin St Infrastructure Interaction

Tree #	Common	Diameter	Interaction Type
44	willow oak	17	Lighting
47	willow oak	14	Overhead Lines
48	callery pear Bradford	19	Overhead Lines
49	callery pear Bradford	16	Overhead Lines
50	pin oak	4	Overhead Lines
53	Chinese elm	14	Building
56	bald cypress	7	Building
56	bald cypress	7	Lighting
57	Japanese zelkova	7	Building
58	bald cypress	7	Building
59	Japanese zelkova	5	Building
60	sugar maple	10	Building
61	dawn redwood	5	Building
62	pin oak	5	Building
64	Darlington oak	11	Building
65	Darlington oak	11	Building
66	Chinese elm	11	Building
67	Chinese elm	5	Building
68	China berry	8	Building
69	pin oak	7	Building
70	Chinese elm	9	Building
71	red maple	9	Building
72	Chinese elm	4	Building
73	Chinese pistache	6	Building
76	sugar maple	10	Building
77	water oak	9	Building
78	pin oak	7	Building
79	sugar maple	9	Overhead Lines
85	willow oak	21	Overhead Lines
85	willow oak	21	Lighting
88	red maple	14	Overhead Lines
89	English elm	15	Overhead Lines
93	willow oak	44	Overhead Lines
96	willow oak	56	Overhead Lines
96	willow oak	56	Lighting
97	willow oak	55	Overhead Lines
97	willow oak	55	Lighting
99	sugar maple	9	Overhead Lines
104	willow oak	37	Overhead Lines
104	willow oak	37	Lighting
105	willow oak	35	Overhead Lines
105	willow oak	35	Lighting
109	willow oak	21	Overhead Lines
109	willow oak	21	Lighting
111	willow oak	17	Lighting
112	willow oak	24	Overhead Lines
112	willow oak	24	Lighting
134	American elm (non-resistant)	28	Building
135	sugar maple	13	Building

viii. Franklin St Infrastructure Interaction

Tree #	Common	Diameter	Interaction Type
136	Chinese elm	12	Building
137	flowering dogwood	7	Building
138	flowering dogwood	7	Building
138	flowering dogwood	7	Sign blockage
139	flowering dogwood	6	Building
140	sugar maple	14	Building
141	pin oak	6	Building
142	Chinese pistache	9	Building
142	Chinese pistache	9	Lighting
143	pin oak	5	Building
146	Chinese elm	8	Building
148	pin oak	9	Building
155	sugar maple	4	Overhead Lines
156	willow oak	13	Overhead Lines
157	red maple	10	Overhead Lines
158	sugar maple	7	Overhead Lines
159	American elm (non-resistant)	28	Overhead Lines
160	willow oak	18	Overhead Lines
161	willow oak	25	Overhead Lines
162	willow oak	16	Building
163	Chinese elm	3	Overhead Lines
164	Chinese elm	3	Overhead Lines
165	willow oak	15	Overhead Lines
165	willow oak	15	Building
166	sugar maple	8	Overhead Lines
167	sugar maple	10	Overhead Lines
168	willow oak	17	Overhead Lines
169	willow oak	21	Overhead Lines
170	willow oak	25	Overhead Lines
174	crape myrtle	5	Overhead Lines
175	crape myrtle	5	Overhead Lines
176	little leaf Linden	23	Overhead Lines
176	little leaf Linden	23	Building
177	little leaf Linden	10	Overhead Lines
178	sawtooth oak	17	Overhead Lines
178	sawtooth oak	17	Building
179	pin oak	18	Overhead Lines
180	Chinese pistache	4	Overhead Lines
181	pin oak	18	Overhead Lines
182	callery pear Bradford	17	Overhead Lines
183	pin oak	12	Overhead Lines
183	pin oak	12	Building
184	willow oak	24	Overhead Lines
184	willow oak	24	Building
185	willow oak	36	Overhead Lines
185	willow oak	36	Building

ix. Franklin St Conditions Observed

Tree #	Common	Diameter	Pest	Notes
11	willow oak	52	conk	
24	willow oak	47	seam/ stem	
78	pin oak	7	wounds/ stem	
87	Siberian elm	26	cavities/ crown	
90	American elm (non-resistant)	40	storm damage	broken branch
92	willow oak	27	cavities/ stem	
92	willow oak	27	conk	
93	willow oak	44	lean	
93	willow oak	44	cavities/ root collar	
93	willow oak	44	cavities/ crown	
94	willow oak	45	cavities/ crown	
98	American elm (non-resistant)	19	wounds/ stem	
102	Siberian elm	19	cavities/ crown	
119	American elm (non-resistant)	33	cavities/ root collar	
120	pin oak	4	wounds/ stem	
127	red maple	14	wounds/ stem	
135	sugar maple	13	wounds/ crown	
139	flowering dogwood	6	wounds/ crown	
147	green ash	55	cavities/ crown	hanger
159	American elm (non-resistant)	28	wounds/ crown	
171	little leaf Linden	12	cavities/ stem	hanger
177	little leaf Linden	10	girdiling roots suspected	
182	callery pear Bradford	17	wounds/ stem	
182	callery pear Bradford	17	storm damage	
185	willow oak	36	cavities/ crown	hangers

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
1	willow oak	26	Quercus	phellos	Large (>35')	Mature	20	1	Fair	51% - 75%	2 Priority
2	willow oak	16	Quercus	phellos	Large (>35')	Mature	20	1	Fair	51% - 75%	2 Priority
3	willow oak	19	Quercus	phellos	Large (>35')	Mature	20	1	Good	51% - 75%	2 Priority
4	red maple	11	Acer	rubrum	Large (>35')	Mature	20	1	Good	51% - 75%	2 Priority
5	Siberian elm	21	Ulmus	pumila	Large (>35')	Mature	20	1	Dead	51% - 75%	1 Priority
6	slippery elm	18	Ulmus	rubra	Large (>35')	Mature	20	1	Poor	51% - 75%	1 Priority
7	willow oak	51	Quercus	phellos	Large (>35')	Mature	30	1	Fair	>75%	2 Priority
8	willow oak	31	Quercus	phellos	Medium (16 to 35')	Mature	20	1	Poor	51% - 75%	2 Priority
9	willow oak	56	Quercus	phellos	Large (>35')	Mature	35	1	Fair	>75%	1 Priority
10	red maple	7	Acer	rubrum	Medium (16 to 35')	Semi-mature	10	1	Good	>75%	3 Priority
11	willow oak	52	Quercus	phellos	Large (>35')	Mature	30	1	Poor	>75%	1 Priority
12	willow oak	21	Quercus	phellos	Large (>35')	Mature	25	1	Fair	>75%	1 Priority
13	willow oak	22	Quercus	phellos	Large (>35')	Mature	25	1	Fair	>75%	1 Priority
14	willow oak	25	Quercus	phellos	Large (>35')	Mature	20	1	Poor	>75%	1 Priority
15	willow oak	21	Quercus	phellos	Large (>35')	Mature	25	1	Fair	>75%	1 Priority
16	willow oak	22	Quercus	phellos	Large (>35')	Mature	30	1	Good	>75%	1 Priority
17	willow oak	35	Quercus	phellos	Large (>35')	Mature	35	1	Poor	>75%	1 Priority
18	sawtooth oak	7	Quercus	accutissima	Medium (16 to 35')	Semi-mature	10	1	Fair	>75%	2 Priority
19	willow oak	25	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	1 Priority
20	willow oak	19	Quercus	phellos	Large (>35')	Mature	20	1	Good	>75%	1 Priority
21	willow oak	23	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	2 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
22	Northern red oak	25	Quercus	rubra	Large (>35')	Mature	25	1	Poor	>75%	1 Priority
23	sawtooth oak	13	Quercus	accutissima	Medium (16 to 35')	Semi-mature	20	1	Fair	>75%	1 Priority
24	willow oak	47	Quercus	phellos	Large (>35')	Mature	25	1	Poor	>75%	1 Priority
25	willow oak	18	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	2 Priority
26	sawtooth oak	10	Quercus	accutissima	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	2 Priority
27	willow oak	13	Quercus	phellos	Large (>35')	Semi-mature	20	1	Fair	>75%	1 Priority
28	willow oak	25	Quercus	phellos	Large (>35')	Mature	30	1	Poor	>75%	1 Priority
29	Northern red oak	8	Quercus	rubra	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
30	Northern red oak	11	Quercus	rubra	Medium (16 to 35')	Young	0	1	Good	>75%	3 Priority
31	Northern red oak	8	Quercus	rubra	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
32	crape myrtle	4	Lagerstroemia	indica	Small (<15')	Semi-mature	10	4	Good	>75%	3 Priority
33	Northern red oak	8	Quercus	rubra	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
34	crape myrtle	3	Lagerstroemia	indica	Small (<15')	Semi-mature	5	2	Good	>75%	3 Priority
35	willow oak	15	Quercus	phellos	Large (>35')	Semi-mature	20	1	Good	>75%	3 Priority
36	pin oak	7	Quercus	palustrus	Medium (16 to 35')	Semi-mature	10	1	Good	>75%	3 Priority
37	pin oak	9	Quercus	palustrus	Large (>35')	Semi-mature	10	1	Good	>75%	2 Priority
38	Japanese maple	4	Acer	palmatum	Small (<15')	Semi-mature	5	1	Good	>75%	3 Priority
39	crape myrtle	5	Lagerstroemia	indica	Small (<15')	Semi-mature	5	2	Good	>75%	3 Priority
40	crape myrtle	4	Lagerstroemia	indica	Small (<15')	Semi-mature	5	1	Good	>75%	3 Priority
41	willow oak	22	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	1 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
42	willow oak	9	Quercus	phellos	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
43	willow oak	9	Quercus	phellos	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
44	willow oak	17	Quercus	phellos	Large (>35')	Mature	20	1	Good	>75%	2 Priority
45	crape myrtle	2	Lagerstroemia	indica	Small (<15')	Young	5	4	Fair	51% - 75%	3 Priority
46	crape myrtle	3	Lagerstroemia	indica	Small (<15')	Young	5	5	Fair	51% - 75%	3 Priority
47	willow oak	14	Quercus	phellos	Large (>35')	Mature	25	1	Fair	>75%	2 Priority
48	callery pear Bradford	19	Pyrus	calleryana	Medium (16 to 35')	Mature	15	1	Fair	>75%	2 Priority
49	callery pear Bradford	16	Pyrus	calleryana	Medium (16 to 35')	Mature	15	1	Good	>75%	2 Priority
50	pin oak	4	Quercus	palustrus	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
51	Northern red oak	7	Quercus	rubra	Large (>35')	Young	10	1	Good	>75%	3 Priority
52	willow oak	27	Quercus	phellos	Large (>35')	Mature	25	1	Poor	>75%	1 Priority
53	Chinese elm	14	Ulmus	parvifolia	Medium (16 to 35')	Semi-mature	20	1	Good	>75%	2 Priority
54	green ash	11	Fraxinus	pennsylvanica	Large (>35')	Mature	15	1	Poor	>75%	1 Priority
55	Japanese zelkova	3	Zelkova	serrata	Small (<15')	Young	5	1	Fair	>75%	3 Priority
56	bald cypress	7	Taxodium	distichum	Medium (16 to 35')	Semi-mature	10	1	Good	>75%	3 Priority
57	Japanese zelkova	7	Zelkova	serrata	Small (<15')	Young	10	1	Good	>75%	3 Priority
58	bald cypress	7	Taxodium	distichum	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
59	Japanese zelkova	5	Zelkova	serrata	Small (<15')	Young	10	1	Good	>75%	3 Priority
60	sugar maple	10	Acer	saccharum	Medium (16 to 35')	Semi-mature	15	1	Poor	>75%	1 Priority
61	bald cypress	5	Taxodium	distichum	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
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62	pin oak	5	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
63	Chinese pistache	5	Pistacia	chinensis	Small (<15')	Young	5	1	Good	>75%	3 Priority
64	Darlington oak	11	Quercus	hemisperica	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	2 Priority
65	Darlington oak	11	Quercus	hemisperica	Medium (16 to 35')	Semi-mature	10	1	Good	>75%	3 Priority
66	Chinese elm	11	Ulmus	parvifolia	Large (>35')	Mature	20	1	Good	>75%	2 Priority
67	Chinese elm	5	Ulmus	parvifolia	Medium (16 to 35')	Young	10	1	Fair	>75%	3 Priority
68	Chinese pistache	8	Pistacia	chinensis	Large (>35')	Mature	20	1	Good	>75%	1 Priority
69	pin oak	7	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
70	Chinese elm	9	Ulmus	parvifolia	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	3 Priority
71	red maple	9	Acer	rubrum	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	3 Priority
72	Chinese elm	4	Ulmus	parvifolia	Small (<15')	Young	10	1	Good	>75%	3 Priority
73	Chinese pistache	6	Pistacia	chinensis	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
74	Darlington oak	5	Quercus	hemisperica	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
75	pin oak	6	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
76	sugar maple	10	Acer	saccharum	Large (>35')	Semi-mature	20	1	Fair	>75%	3 Priority
77	water oak	9	Quercus	nigra	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
78	pin oak	7	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Fair	>75%	3 Priority
79	sugar maple	9	Acer	saccharum	Medium (16 to 35')	Semi-mature	15	1	Fair	51% - 75%	3 Priority
80	sawtooth oak	14	Quercus	accutissima	Large (>35')	Mature	20	1	Good	51% - 75%	3 Priority
81	green ash	17	Fraxinus	pennsylvanica	Large (>35')	Mature	25	1	Good	51% - 75%	3 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
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82	willow oak	7	Quercus	phellos	Medium (16 to 35')	Young	10	1	Good	51% - 75%	3 Priority
83	willow oak	7	Quercus	phellos	Medium (16 to 35')	Young	10	1	Good	25% - 50%	3 Priority
84	willow oak	5	Quercus	phellos	Medium (16 to 35')	Young	10	1	Good	25% - 50%	3 Priority
85	willow oak	21	Quercus	phellos	Large (>35')	Mature	30	1	Good	51% - 75%	2 Priority
86	willow oak	54	Quercus	phellos	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
87	Siberian elm	26	Ulmus	pumila	Large (>35')	Mature	30	1	Poor	51% - 75%	1 Priority
88	red maple	14	Acer	rubrum	Large (>35')	Mature	20	1	Fair	51% - 75%	2 Priority
89	English elm	15	Ulmus	procera	Large (>35')	Mature	20	1	Fair	51% - 75%	2 Priority
90	American elm (non-resistant)	40	Ulmus	americana	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
91	willow oak	32	Quercus	phellos	Large (>35')	Mature	35	1	Good	51% - 75%	1 Priority
92	willow oak	27	Quercus	phellos	Large (>35')	Mature	30	1	Fair	51% - 75%	1 Priority
93	willow oak	44	Quercus	phellos	Large (>35')	Mature	30	1	Fair	51% - 75%	1 Priority
94	willow oak	45	Quercus	phellos	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
95	willow oak	46	Quercus	phellos	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
96	willow oak	56	Quercus	phellos	Large (>35')	Mature	45	1	Fair	51% - 75%	1 Priority
97	willow oak	55	Quercus	phellos	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
98	American elm (non-resistant)	19	Ulmus	americana	Large (>35')	Mature	30	1	Poor	51% - 75%	1 Priority
99	sugar maple	9	Acer	saccharum	Medium (16 to 35')	Semi-mature	15	1	Good	51% - 75%	1 Priority
100	Siberian elm	25	Ulmus	pumila	Large (>35')	Mature	30	1	Fair	51% - 75%	2 Priority
101	eastern redcedar	21	Juniperus	virginiana	Large (>35')	Mature	20	1	Fair	51% - 75%	3 Priority
102	Siberian elm	19	Ulmus	pumila	Large (>35')	Mature	25	1	Poor	51% - 75%	1 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
103	red maple	14	Acer	rubrum	Large (>35')	Mature	20	2	Fair	51% - 75%	1 Priority
104	willow oak	37	Quercus	phellos	Large (>35')	Mature	40	1	Good	51% - 75%	1 Priority
105	willow oak	35	Quercus	phellos	Large (>35')	Mature	35	1	Fair	51% - 75%	1 Priority
106	willow oak	4	Quercus	phellos	Small (<15')	Young	5	2	Good	25% - 50%	3 Priority
107	willow oak	24	Quercus	phellos	Large (>35')	Mature	30	1	Fair	51% - 75%	2 Priority
108	willow oak	24	Quercus	phellos	Large (>35')	Mature	30	1	Fair	51% - 75%	1 Priority
109	willow oak	21	Quercus	phellos	Large (>35')	Mature	20	1	Fair	51% - 75%	1 Priority
110	willow oak	19	Quercus	phellos	Large (>35')	Mature	25	1	Good	51% - 75%	2 Priority
111	willow oak	17	Quercus	phellos	Large (>35')	Mature	25	1	Fair	51% - 75%	2 Priority
112	willow oak	24	Quercus	phellos	Large (>35')	Mature	30	1	Good	51% - 75%	1 Priority
113	willow oak	29	Quercus	phellos	Large (>35')	Mature	40	1	Fair	51% - 75%	1 Priority
114	willow oak	28	Quercus	phellos	Large (>35')	Mature	30	1	Good	51% - 75%	1 Priority
115	willow oak	10	Quercus	phellos	Medium (16 to 35')	Semi-mature	10	1	Good	51% - 75%	3 Priority
116	American elm (non-resistant)	36	Ulmus	americana	Large (>35')	Mature	35	1	Fair	51% - 75%	1 Priority
117	willow oak	15	Quercus	phellos	Large (>35')	Semi-mature	25	1	Good	51% - 75%	2 Priority
118	American elm (non-resistant)	30	Ulmus	americana	Large (>35')	Mature	40	1	Poor	51% - 75%	1 Priority
119	American elm (non-resistant)	33	Ulmus	americana	Large (>35')	Mature	25	1	Poor	51% - 75%	1 Priority
120	pin oak	4	Quercus	palustrus	Small (<15')	Young	5	1	Fair	51% - 75%	3 Priority
121	Japanese maple	1	Acer	palmatum	Small (<15')	New Planting	5	1	Good	<25%	
122	Darlington oak	3	Quercus	hemisperica	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
123	Chinese pistache	3	Pistacia	chinensis	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
124	pin oak	5	Quercus	palustrus	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
125	red maple	16	Acer	rubrum	Medium (16 to 35')	Semi-mature	10	1	Poor	>75%	1 Priority
126	pin oak	4	Quercus	palustrus	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
127	red maple	14	Acer	rubrum	Large (>35')	Mature	10	1	Poor	>75%	1 Priority
128	Chineses pistache	3	Pistacia	chinensis	Small (<15')	Young	10	1	Good	>75%	3 Priority
129	pin oak	5	Quercus	palustrus	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
130	red maple	15	Acer	rubrum	Large (>35')	Mature	10	1	Fair	>75%	1 Priority
131	shingle oak	4	Quercus	imbricaria	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
132	Darlington oak	4	Quercus	hemisperica	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
133	Chinese pistache	4	Pistacia	chinensis	Small (<15')	Young	5	1	Good	>75%	3 Priority
134	American elm (non-resistant)	28	Ulmus	americana	Large (>35')	Mature	35	1	Fair	>75%	1 Priority
135	sugar maple	13	Acer	saccharum	Large (>35')	Semi-mature	15	1	Fair	>75%	2 Priority
136	Chinese elm	12	Ulmus	parvifolia	Medium (16 to 35')	Semi-mature	20	1	Good	>75%	2 Priority
137	flowering dogwood	7	Cornus	florida	Medium (16 to 35')	Mature	15	1	Fair	>75%	2 Priority
138	flowering dogwood	7	Cornus	florida	Medium (16 to 35')	Mature	15	1	Fair	51% - 75%	3 Priority
139	flowering dogwood	6	Cornus	florida	Medium (16 to 35')	Mature	10	1	Good	51% - 75%	3 Priority
140	sugar maple	14	Acer	saccharum	Large (>35')	Mature	10	1	Fair	>75%	1 Priority
141	pin oak	6	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
142	Chinese pistache	9	Pistacia	chinensis	Medium (16 to 35')	Semi-mature	10	1	Good	>75%	2 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
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143	pin oak	5	Quercus	palustrus	Medium (16 to 35')	Young	10	1	Good	>75%	3 Priority
144	crape myrtle	3	Lagerstroemia	indica	Small (<15')	Semi-mature	5	5	Good	>75%	3 Priority
145	crape myrtle	0	Lagerstroemia	indica	Small (<15')	Semi-mature	5	5	Good	>75%	3 Priority
146	Chinese elm	8	Ulmus	parvifolia	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	3 Priority
147	green ash	55	Fraxinus	pennsylvanica	Large (>35')	Mature	40	1	Fair	>75%	1 Priority
148	pin oak	9	Quercus	palustrus	Medium (16 to 35')	Semi-mature	15	1	Good	51% - 75%	3 Priority
149	Shumard oak	5	Quercus	shumardii	Medium (16 to 35')	Young	10	1	Good	51% - 75%	3 Priority
150	Northern red oak	5	Quercus	rubra	Medium (16 to 35')	Young	10	1	Good	51% - 75%	3 Priority
151	Northern red oak	5	Quercus	rubra	Medium (16 to 35')	Young	5	1	Good	51% - 75%	3 Priority
152	Shumard oak	6	Quercus	shumardii	Medium (16 to 35')	Young	5	1	Good	51% - 75%	3 Priority
153	American elm (non-resistant)	20	Ulmus	americana	Large (>35')	Mature	25	1	Dead	>75%	1 Priority
154	American elm (non-resistant)	19	Ulmus	americana	Large (>35')	Mature	25	1	Poor	>75%	1 Priority
155	sugar maple	4	Acer	saccharum	Small (<15')	Young	5	1	Poor	51% - 75%	3 Priority
156	willow oak	13	Quercus	phellos	Large (>35')	Semi-mature	20	1	Good	>75%	1 Priority
157	red maple	10	Acer	rubrum	Large (>35')	Mature	20	2	Fair	>75%	2 Priority
158	sugar maple	7	Acer	saccharum	Medium (16 to 35')	Young	10	1	Poor	51% - 75%	2 Priority
159	American elm (non-resistant)	28	Ulmus	americana	Large (>35')	Mature	35	1	Fair	>75%	1 Priority
160	willow oak	18	Quercus	phellos	Large (>35')	Semi-mature	20	1	Good	>75%	2 Priority
161	willow oak	25	Quercus	phellos	Large (>35')	Mature	30	1	Fair	>75%	1 Priority
162	willow oak	16	Quercus	phellos	Large (>35')	Semi-mature	20	1	Fair	>75%	2 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
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163	Chinese elm	3	Ulmus	parvifolia	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
164	Chinese elm	3	Ulmus	parvifolia	Small (<15')	Young	5	1	Good	51% - 75%	3 Priority
165	willow oak	15	Quercus	phellos	Large (>35')	Semi-mature	20	1	Fair	>75%	2 Priority
166	sugar maple	8	Acer	saccharum	Medium (16 to 35')	Semi-mature	10	1	Poor	>75%	2 Priority
167	sugar maple	10	Acer	saccharum	Medium (16 to 35')	Semi-mature	15	1	Good	>75%	2 Priority
168	willow oak	17	Quercus	phellos	Large (>35')	Semi-mature	20	1	Poor	>75%	1 Priority
169	willow oak	21	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	1 Priority
170	willow oak	25	Quercus	phellos	Large (>35')	Mature	20	1	Fair	>75%	1 Priority
171	little leaf Linden	12	Tilia	cordata	Medium (16 to 35')	Young	10	1	Fair	>75%	1 Priority
172	willow oak	34	Quercus	phellos	Large (>35')	Mature	40	1	Fair	>75%	1 Priority
173	ginkgo (male)	1	Ginkgo	biloba	Small (<15')	New Planting	5	1	Good	>75%	
174	crape myrtle	5	Lagerstroemia	indica	Small (<15')	Mature	10	3	Fair	51% - 75%	2 Priority
175	crape myrtle	5	Lagerstroemia	indica	Small (<15')	Mature	10	1	Good	51% - 75%	2 Priority
176	little leaf Linden	23	Tilia	cordata	Large (>35')	Mature	15	1	Fair	>75%	1 Priority
177	little leaf Linden	10	Tilia	cordata	Small (<15')	Semi-mature	10	1	Fair	51% - 75%	2 Priority
178	sawtooth oak	17	Quercus	accutissima	Large (>35')	Mature	20	1	Poor	>75%	1 Priority
179	pin oak	18	Quercus	palustrus	Large (>35')	Mature	25	1	Good	>75%	2 Priority
180	Chinese pistache	4	Pistacia	chinensis	Small (<15')	Young	5	1	Good	>75%	2 Priority
181	pin oak	18	Quercus	palustrus	Large (>35')	Mature	25	1	Poor	>75%	1 Priority
182	callery pear Bradford	17	Pyrus	calleryana	Large (>35')	Mature	20	1	Fair	>75%	1 Priority

x. Franklin St Entire Inventory

Tree #	Common	Diameter	Genus	Species	Height	Age Class	Can Rad	Stem	Cond	Root Infri	GTW Pr
183	pin oak	12	Quercus	palustrus	Medium (16 to 35')	Semi-mature	15	1	Poor	51% - 75%	1 Priority
184	willow oak	24	Quercus	phellos	Large (>35')	Mature	25	1	Poor	51% - 75%	1 Priority
185	willow oak	36	Quercus	phellos	Large (>35')	Mature	25	1	Poor	51% - 75%	1 Priority



ROOT COLLAR DISORDERS

A tree’s root collar is the area where the roots join the trunk. Root collars flare out from the trunk before leading down to the major roots.

Although root collars may look like roots, this area of a tree is actually part of the trunk. The trunk, unlike roots, is not specialized to resist constant soil moisture. Root collars are meant to be exposed to air, not covered with soil--as we see when trees are excessively mulched or buried too deeply.

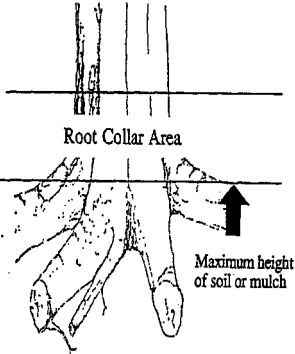
When soil covers the root collar, movement of oxygen and carbon dioxide in and out of the inner bark is inhibited. Over a period of years, lack of gas exchange will kill cells and interfere with the downward movement of food to the roots. Eventually you will see root dieback and reduced water uptake, leaving the tree more susceptible to infection and disease.

Problems with buried root collars occur in a number of different situations. Most commonly you will see root collars buried during landscaping projects when fill soil is distributed around the tree. In addition, transplanted trees may settle or be set too deeply in the planting hole. Some trees may even arrive from the nursery with excess soil against the root collar.

Excessive mulch also can lead to death of the root collar. A good rule is that mulch layers should not exceed four inches in thickness and should not be placed against the root collar.

Early symptoms of root collar disorders are yellowing foliage, early leaf coloration and drop, and dieback in the upper crown. Some trees, though, will show no symptoms at all prior to their death during a hot dry period of the summer.

Secondary invaders such as canker disease fungi and insect borers often invade trees stressed by root collar problems. These cankers may cause sunken areas near the soil line. Winter injury is common as well, though usually not apparent until spring. Disruption of the transportation of food and other necessary materials in the tree inhibits growth regulators responsible for hardening off in preparation for winter. The tree is then prone to cold weather damage.



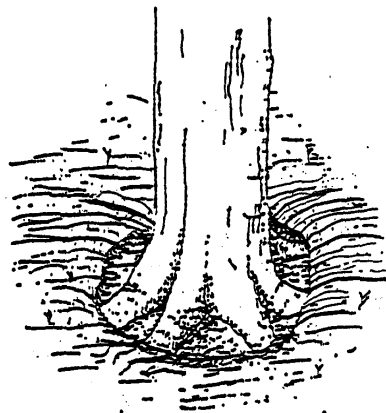
ROOT COLLAR DISORDERS

Most tree and shrub species are susceptible to problems from buried root collars. Very sensitive plants include sugar maple, California live oak, dogwood, Japanese black pine and Eastern white pine.

The easiest way to check a tree for a root collar disorder is to look for natural root flare. If no flare is present, an excavation should be made to locate the buttress roots. From this, we can determine whether or not the soil or mulch against the collar has started to cause problems.

If a tree is severely declining from a root collar disorder, removal is recommended before the tree becomes hazardous. If symptoms are detected early, remedial actions can be taken that may save the tree. All soil or mulch in contact with the root collar should be removed.

Root collar excavations can be done by carefully using small digging tools and a brush or with a new tool called an air spade. The Air Spade will excavate the soil around the tree by directing a high pressure, high velocity stream of air at the soil. This separates the soil particles and lifts them up and away with the air stream. This method of performing root collar excavations is the least intrusive to the tree's root system.



Excavated root collar

The second priority to save a tree from root collar injury is fertilization. The third action is to provide appropriate irrigation during dry periods. Most tree species require one inch of water per week during the growing season. Care should be taken not to overwater. Irrigation water should never be applied directly to the trunk or root collar area.

In summary, trees and shrubs with buried root collars may decline and are more susceptible to attack by secondary pests. It is best to treat the situation as soon as it is discovered by means of a root collar excavation. Other corrective treatments such as fertilizing and mulching will promote tree health and improve chances for recovery.



Maintenance Pruning Standard: A Simplified View

***E. Thomas Smiley, Ph. D., Plant Pathologist
Bruce R. Fraedrich, Ph. D., Plant Pathologist***

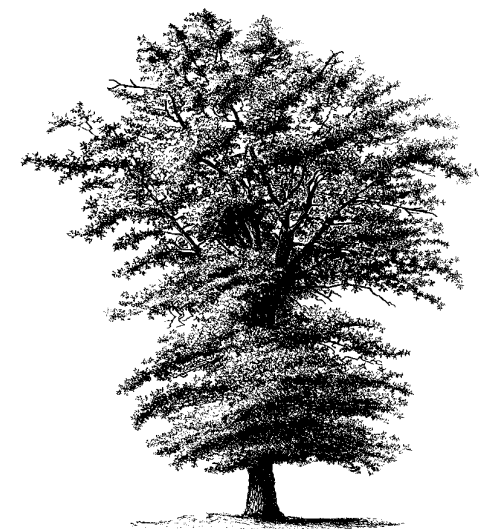
“Correct pruning cuts should be made close to the branch collar. Do not leave stubs and do not injure the collar”. For many years, correct removal of branches has been synonymous with proper tree pruning. The new American National Standards Institute (ANSI) A-300 Pruning Standard brings the *tree* back into focus. It places emphasis on developing pruning goals based on specific needs of the plant. The Standard also provides clear, concise and descriptive terminology that arborists, tree workers and consumers can readily understand.

When pruning, arborists must decide which branches to remove. Will only defective limbs be removed or is there a benefit to thinning out live branches? Should the tree remain the same height and spread or are reductions necessary? Are low limbs interfering with traffic and require raising? What is the size limit on branches to be removed?

Before removing any branches, several factors must be considered. What is the condition of the tree? What are the landscape functions provided by the tree? Will pruning maintain or enhance those functions? Are structural defects or storm damage present that should be removed? Are branches interfering with powerlines,

houses, and walkways? Is the tree too dense or does it need shaping? Will the tree tolerate removal of live branches? What are the customer's expectations and budget? The answers to these questions will govern how and to what extent the tree is pruned.

Four basic pruning techniques are used to maintain trees. Depending on tree requirements, client expectations and budget, one or more of the techniques will be used to maintain the plant.



Before pruning

Crown thinning is the removal of live, healthy branches on trees with dense crowns. This improves light penetration and air movement, and decreases wind resistance, thus reducing pest infestations and decreasing the risk of storm damage.



Crown thinning

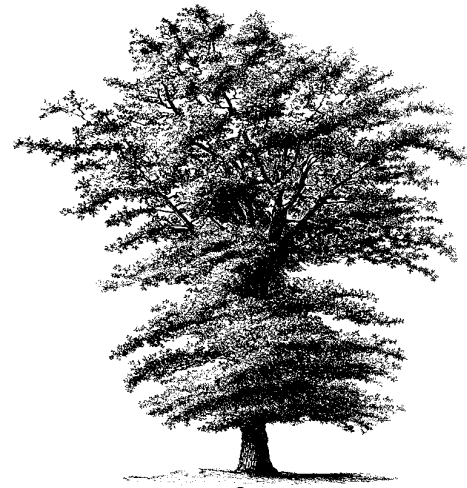
Thinning can also be used to reduce weight of individual limbs and to slow the growth rate on overly vigorous limbs. This pruning technique is most commonly needed on young, rapidly growing trees.

On slower growing mature trees, thinning is mainly used when weight reduction is needed on individual limbs to compensate for structural defects. Usually, thinning is performed in conjunction with crown cleaning.

Virtually all-urban trees benefit from periodic **crown cleaning**. This is the removal of defective limbs including those that are dead, dying, diseased, rubbing, and structurally unsound. Cleaning reduces the risk of branch failures, improves plant health and enhances tree appearance by removing limbs that are unsightly, unhealthy and unsound.

Although removal of healthy branches is technically "thinning", selective removal of watersprouts is included in the cleaning specification. Before selecting this option, arborists must judge whether sprout

removal will benefit the tree. Stripping sprouts is rarely beneficial and may eventually create many more problems for the tree. The Standard also states that **one-half of the foliage should be evenly distributed in the lower two-thirds of the**



crown and individual limbs.

Crown cleaning

Unnecessary sprout removal and removal of all lower branches would certainly violate this rule. The concept of not removing sprouts must be clearly conveyed to consumers since many homeowners equate proper pruning with removal of interior limbs. There are a few exceptions where removal of watersprouts is beneficial. Removing sprouts on dogwoods in areas where *Discula* anthracnose is present is recommended to reduce risk of cankers in larger branches, for example.

Leaving interior and lower branches on a tree is equally important when thinning the crown. In order not to violate the *one-half the foliage on the lower two-thirds* rule, the majority of thinning cuts are on the outer portion of the crown, not the inside. This means working with pole tools or from an aerial lift. After large deadwood and structural problems have been corrected using a chainsaw, hand or pneumatic tools are used for thinning.

Crown reduction is needed on trees or individual limbs that are growing close to

Crowing raising

the trunk or downward growing branches can be removed at the parent limb. Thinning the ends of a heavy limb may accomplish the same goal if the limb raises when weight is removed. When raising is performed, limb levels generally are left at a uniform height around the tree to provide symmetry.

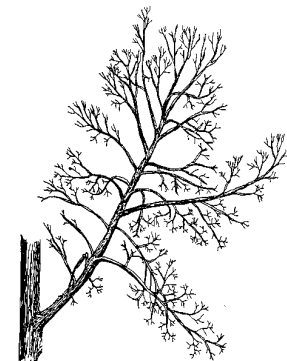
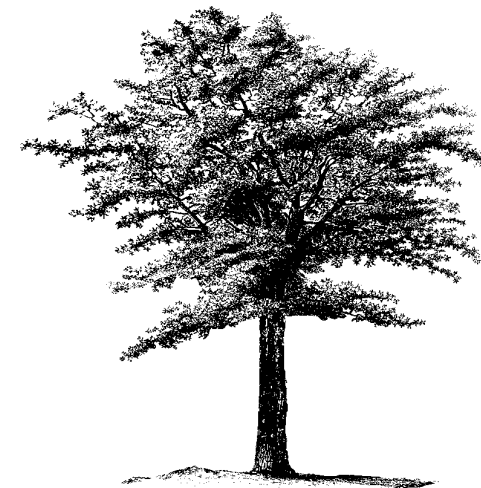
These are the four primary types of maintenance pruning - **thinning, cleaning, reduction and raising**. Other pruning techniques and systems are discussed in the Standard, including **crown restoration, vista pruning, young tree pruning, espalier, pollarding and palm pruning**. These techniques are generally performed to achieve specific goals that are separate from maintenance considerations or are oriented to a specific type of tree. Consult the Standard for descriptions of these pruning types.

The majority of established trees can benefit from **one or more** maintenance pruning types. How can you prune a tree in more than one way? Easy! If a tree is

buildings, other trees, or utility wires. Reduction may also be necessary to prevent or correct storm damage and to shorten errant branches to provide a more desirable shape. This type of pruning involves reducing the height or spread of the crown or individual limbs. Certain species such as beech and sugar maple respond poorly to reductions so consideration must be given to the ability of the species to tolerate this procedure.

When reducing a leader or branch cut back to a lateral branch that is large enough to assume dominance. The size of the remaining lateral is not specified in the Standard since it varies with tree species and tree condition. Typically, a lateral one-third the diameter of the parent limb is selected. If the lateral is smaller, the limb will either dieback or sprout profusely. If the lateral is considerably larger than the one-third guideline, then thinning the remaining lateral should be considered due to the risk of storm damage. The remaining lateral should be growing in a direction that will maintain a desirable shape and not interfere with objects within the pruning cycle.

When lower limbs interfere with mowing, traffic, people or utilities, pruning is needed to provide clearance. While removal of lower limbs goes under many names, the one that has been selected is **crown raising**. Limbs can either be removed at



Before pruning

growing next to a house and has deadwood and limbs rubbing against the roof, it needs crown cleaning throughout and reduction or raising of the limbs over the residence. You may use any of the techniques, or combination of techniques, to provide exactly what the tree needs and the customer wants. Choosing the correct

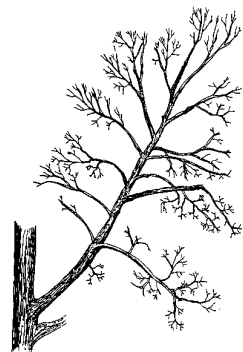
pruning technique(s) is relatively easy, even for an inexperienced arborist, because the tree guides the decision making process. If the tree has deadwood - clean it; if overly thick - thin it; if too tall - reduce it; if too low - raise it. Once the technique(s) have been decided, and then the **size of the smallest limb** to prune is the next consideration. Typically, the sizes that have been used are 1/2", 1", 2" or 4". However, no numbers are specified in the Standard so you can select any size that meets the needs of the specific tree and customer objectives. If 1" minimum is selected, then limbs 1" in diameter at the point of attachment and larger would be removed when the branches meet the requirements of the technique.

The size of the smallest limb to be pruned should be adjusted for the tree and the client's budget. When crown cleaning a small tree such as a Japanese maple, the smallest branch to remove might be specified at 1/2 inch in diameter. This means that dead, dying, diseased or weak branches greater than 1/2 inch are removed. If 1/4" diameter is chosen instead, the time required to complete the task is easily doubled or tripled.

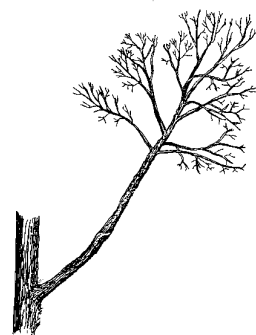
Arborists and consumers must realize that more is **not** always better when it comes to pruning. The amount of foliage that should be pruned from mature trees is now less than before. The Standard specifies that

not more than one quarter of the leaf surface be removed during a single pruning operation. This will benefit the tree by maintaining a greater leaf surface area for producing photosynthates (energy).

When work is sold, whether to a municipality, commercial account or residential client, the pruning technique and minimum branch size must be specified, explained and discussed. This will foster fair competition and help ensure that both client and arborist understand what is to be accomplished by pruning. There should be no surprises for the client when purchasing tree work. To ensure this, tree workers as well as the arborist must understand the Standard. If a client selects crown cleaning but budget constraints require pruning 2" and larger limbs, then the crew cannot take the time to remove 1/2-inch limbs. In summary, the new Standard encourages arborists to prune trees based on the tree's need. This is a significant improvement from the days when we tried to "fit" the tree to a predetermined, artificial classification. Basing pruning on the tree's needs make the principles described hold true for hardwoods and conifers, small ornamentals and large shade trees, young trees and mature trees. The terminology in the Standard is a change for most arborists, but it is user friendly and descriptive. Industry professionals as well as consumers should readily adopt the terminology and techniques.



Correct pruning



Improper pruning



Phytophthora Canker

Many *Phytophthora* species attack shade trees and landscape ornamentals causing diseases including root and root collar decay, stem cankers and foliage lesions. *Phytophthora cactorum* is the most common causal agent for bleeding canker in hardwoods, and was first reported on Maple in New Jersey in 1940. In addition to shade and ornamental trees, fruit and nut trees are susceptible to Phytophthora canker. In addition to cankers, *P. cactorum* also causes fruit and root rot and twig dieback on some plant species. This fungus occurs from California to the Northeast and throughout Canada as well. Other species of *Phytophthora* are associated with bleeding cankers including *P. ramorum* and *P. inflata*.

PATHOGEN

Phytophthora belongs to a group of primitive fungi known as the water molds. These fungi thrive in areas of high moisture content. Phytophthora is primarily soil-borne and moves through saturated soils as motile zoospores. The fungus also has other spore forms that support long-term survival of the organism. When any of these spores come in contact with wounds or succulent plant tissue, germination occurs and the fungus invades the plant tissue. Plants in poor health are more susceptible to invasion from *Phytophthora*. It is poorly understood how infection of stem tissue occurs, but possibilities include rain-splash from soil, insect vectors and movement of infected plants and soil.

HOSTS

P. cactorum attacks plants in over 80 genera. Trees that display bleeding canker symptoms include American and European beech; sweet birch; flowering and Pacific dogwoods; sweet gum; horse-chestnut; linden; madrone; black, Norway, red, silver, sugar, and sycamore maples; California live, southern live, pin, and red oaks; tulip tree; weeping willow; avocado; apple; citrus and other fruit trees.

Typical *Phytophthora* canker on lower trunk of White Oak.



SYMPTOMS

Leaf number and size will be decreased in older trees that become infected with this pathogen. Chlorosis will usually accompany these symptoms along with branch dieback. A furrowed appearance on the trunk and fluid exudation from a darkened canker will usually be present. Bacterial cankers produce similar symptoms on the trunk, but also produce a fermented, fruity odor.



DIAGNOSIS

Early detection of symptoms will lead to further inspection of the trunk and collar area. Cankers are generally elongate, with the phloem and sapwood stained reddish-brown, which is evident upon removal of the bark. Cankers produce characteristic oozing of darkened sap on bark surface. This fungus produces no fruiting bodies, so an accurate and thorough investigation of symptoms is necessary. If *Phytophthora* is suspected, a sample of infected wood and bark should be collected and screened using a field ELISA detection kit or submitted to a diagnostic lab for testing and confirmation. A hole saw or wood chisel should be used to collect infected cambial tissue below the bark surface.



DISEASE MANAGEMENT

Irrigate as needed to maintain soil moisture, but not to excess. Use tensiometers to monitor soil moisture. Avoid excessive moisture contact with the trunk by the use of a soaker hose instead of sprinkler irrigation. Reduce practices that produce tender succulent growth such as high-nitrogen fertilizer. In some severe cases trees might have to be removed to prevent inoculum spread to healthy plants. Mildly affected trees are known to recover, but if the root flare is not visible, removal of soil, mulch and ground covers is recommended. In addition to these practices, soil applications of systemic fungicides may help arrest further development of the disease. In California, Copper fungicide sprays to the bark are being recommended to prevent infection by the *Phytophthora* that causes Sudden Oak Death.



MoniTor IPM program

Bartlett offers a progressive, effective alternative to conventional landscape pest control that I recommend for your property. This would be the most efficient way to manage the insect and disease pest of the plants throughout the property. Bartlett's Integrated Pest Management (IPM) program is called MoniTor, this program requires a greater investment of time, but dramatically reduces the amount of pesticides used by as much as 90 percent. With MoniTor we optimize suppression while minimizing the use of pesticides through preventive maintenance and early detection of problems.

The MoniTor program consists of scheduled visits to inspect the plants around the property for insects, mites, diseases or cultural problems. Nonchemical interference is given first priority. For example, mulching and the release of beneficial insects can be very effective in some instances. When stronger control is needed, we use horticultural oil, insecticidal soap and several of the synthetic pyrethrums. Chemical control is always the last alternative.

Most MoniTor program are designed as follows:

- Schedule a series of inspections for all the woody plants by a trained IPM monitor.
- During each inspection, the monitor will identify and treat insect and disease problems. Low level, non-harmful insect populations will not be treated unless damage to the plant exceeds a tolerable level. Health and aesthetic appearance will determine this level.
- Identification of beneficial insects also would be performed. When present in sufficient numbers, these predatory insects may help control harmful insects, avoiding the use of chemicals.
- If a spray application is warranted, the most benign product available will be used. These products will usually be naturally occurring materials such as oil, soap, pyrethrums or a synthetic material of similar properties. Such products minimally impact both beneficial insects and the environment.
- Cultural treatments such as soil pH adjustment, root collar inspections and mulch adjustments will be included.
- This program will be limited to trees less than 40 feet in height.
- You will receive a written report from the monitor following each inspection. This report will include: description of problems, treatments applied, observations of plant conditions and recommendations.
- As needed, we will perform soil tests in problem areas to identify pH, nutrient or other soil concerns as well as conduct insect and disease analysis from Bartlett's Research Laboratories when problems cannot be identified on site.

An investment in the MoniTor IPM program is an environmentally sound means to maintain your plants in top condition.



Tree Structure Evaluation

Bruce R. Fraedrich, Ph. D., Plant Pathologist

The urban forest is aging and declining at an increasing rate. At the same time, society is becoming more litigious. As a result, detection, evaluation and management of defective trees now are a major concern for arborists, urban foresters and park managers.

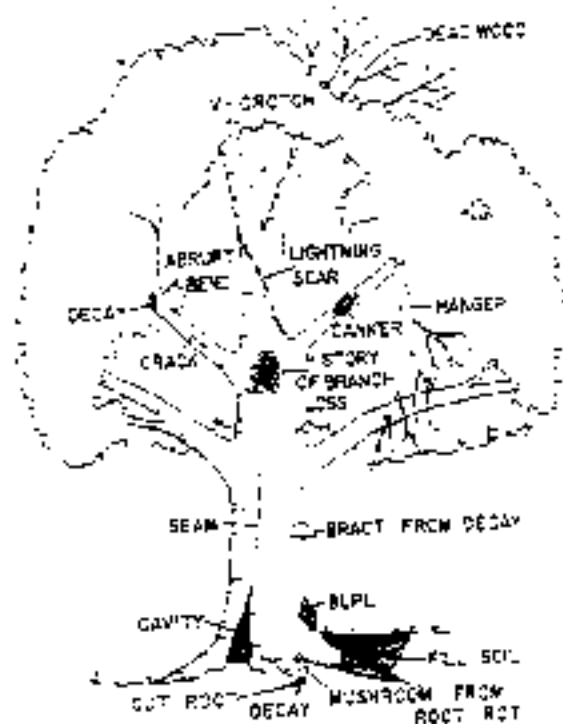
HAZARDOUS TREES DEFINED

A tree is considered hazardous when it has a structural defect that predisposes it to failure and the tree is located near a target (an area where property damage or personal injury could occur if the tree failed). Targets include areas around structures, walkways, roadways, campsites and other areas where there are property and people.

Structurally sound trees also may be hazardous if plant parts interfere with routine activities of people such as obstructing motorists' vision, raising sidewalk, interfering with utilities, roadways or walkways.

LIABILITIES

Property owners/managers have a legal obligation to (1) periodically inspect trees for defects and unsafe conditions and (2) correct defects and unsafe conditions immediately upon detection. If a property owner/manager employs an arborist to perform work on site, the arborist may assume at least some of the responsibility for detecting defective tree conditions and recommending remedial treatments. Arborists are considered "experts" and may



be held accountable for uncorrected or unreported tree defects, which are not obvious to the average property owner.

HAZARD TREES DUE TO STRUCTURAL DEFECTS

A thorough inspection of the branches, stem, root crown and area around the root system is essential in detecting hazardous conditions. Binoculars are helpful in detecting defects in the upper crown. In some instances an aerial lift or climber may be needed to provide a detailed evaluation.

Common structural defects include dead trees, dead branches, stubs from topping cuts, broken branches (hangers), abrupt bends in branches, "V" crotches and multiple stems from the root collar (coppice growth). Failure also is more common in trees with an unbalanced crown or leaning stem if there is a defect.

WOOD DECAY DETECTION AND EVALUATION

Many failures in branches and stems result from loss in structural integrity due to wood decay. When evaluating decayed stems and branches, arborists have generally relied on qualitative parameters for formulating recommendations. These parameters include the location and relative size of the defect, tree species characteristics, site exposure, crown size, leaning stems, owner's "attitude" toward the tree and target considerations.

A method is now available that allows the arborist to quantitatively estimate a strength loss value from wood decay which then can be used with the qualitative parameters listed above to determine more precisely if a tree is prone to failure due to wood decay.

Evaluating decay is a four-step process involving:

1. Decay Detection - Symptoms and signs
2. Measuring the size of the decay column
3. Calculating strength loss value due to decay.
4. Selecting a strength loss value "threshold" for wood decay (taking into consideration the strength loss from decay and qualitative factors previously listed).

DETECTION

Symptoms of wood decay can be quite obvious such as open cavities, loose bark/exposed punky wood and fungal fruiting structures growing from the bark or exposed wood. Other symptoms of wood

decay can be subtler such as seams, cracks, abnormal flare, burls, stubs and cankers. Decay is often associated with multiple stems from the root collar (coppice growth) and in limbs with abrupt bends. When inspecting trees for decay, make sure the crown and stem is thoroughly examined. Binoculars are helpful for inspecting the crown. In some instances, a climber or aerial lift may be necessary for a satisfactory inspection of the upper crown.

MEASURING THE DECAY COLUMN

The diameter of the decay column is determined by measuring the thickness of sound wood at the weakest point on the stem or branch. The average sound wood thickness is multiplied by 2 and subtracted from the total wood diameter to arrive at the diameter of the decay column. Note wood diameter equals the stem/branch diameter minus twice the bark thickness.

The thickness of the "shell" of sound wood can be rapidly determined with minimum damage using a drill with a 1/8" drill bit. The drill bit is inserted until resistance decreases when decayed tissues are encountered. The inserted portion of the drill is then extracted and measured to determine the thickness of sound wood.

An increment borer also can be used to extract a core of sound wood, which can be measured. This is useful on trees with soft wood where it may be difficult to detect the resistance change between healthy and decayed wood. The increment core is more damaging and slower than the drilling technique.

A Shigometer also can be used to assess healthy, decayed and discolored wood.

A minimum of three sampling sites is used and the values are averaged to calculate the decay column diameter. More sampling is necessary in trees over 30 inches in diameter or when measurements vary greatly.

DETERMINING STRENGTH LOSS VALUES FROM WOOD DECAY IN STANDING TREES

Principally the outer rings of wood provide strength in woody stems and branches. Trees can withstand considerable loss of the inner cylinder without a significant loss in structural integrity. Strength loss resulting from decay in wood tissues can be estimated by comparing the diameter of the decay column to the total diameter of the stem.

This technique is based on engineering formulas used in estimating strength loss in pipes due to corrosion. In pipes, strength loss estimates are as follows:

$$\% \text{ Strength Loss} = \frac{\text{Inside Diameter (hollow)}^4}{\text{Total Diameter}^4} \times 100$$

Wagener (1) modified this formula for trees as follows:

$$\text{Strength Loss (SL)} = \frac{(\text{Diameter of Decay Column})^3}{(\text{Diameter of Stem})^3} \times 100$$

$$\text{or } SL = \frac{d^3}{D^3} \times 100$$

Due to the modification, values derived from use of this formula should be viewed as a relative measure of strength loss rather than an actual measure. Values measured against a scale where 0 (zero) equals no strength loss and 100 equals total loss in strength.

When trees have open cavities, the reduction in strength from loss of the outer rings of wood must be entered into the strength loss formula. Loss in strength from open cavities is significant because the outer rings of wood provide most of the structural strength.

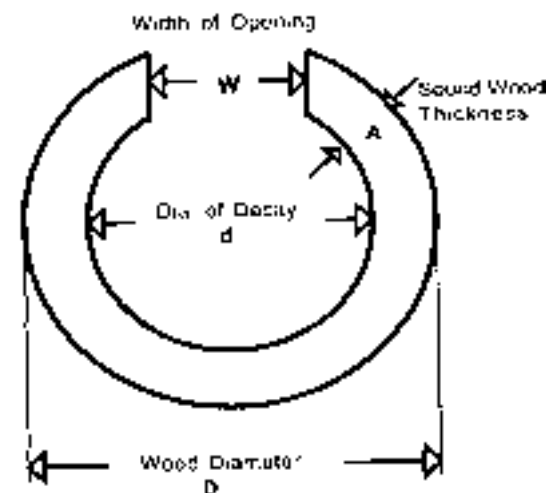
The F.A. Bartlett Tree Expert Co. uses a variation of the formula proposed by Wagener to determine strength loss in stems from open cavities. This formula is as follows:

$$\text{Strength Loss (SL)} = \frac{(\text{Diameter of Decay Column})^3 + \text{Area of Cavity}}{(\text{Diameter of Stem})^3}$$

$$\text{or } SL = \frac{d^3 + R(D^3 - d^3)}{D^3} \times 100$$

SL = Strength Loss
d = Diameter of Decay Column
D = Stem Diameter (inside bark)
R = Ratio of Cavity Opening to Stem Circumference
(R = width of cavity opening)

Values derived from this formula should also be viewed as a relative measure of strength loss as described above.



STRENGTH LOSS VALUE THRESHOLDS

Wagener (1) stated that West Coast conifers could tolerate up to a one-third loss in strength without predisposing the stem to unreasonable risk of failure if the weakening effect is heart rot uncomplicated by other defects. Wagener emphasizes that the one-third-strength loss value is not absolute and is only a general guideline.

Smiley and Fraedrich (2) surveyed hardwood trees that were broken during 1989's Hurricane Hugo in Charlotte, NC. Sustained winds were 69 miles per hour (mph) with gusts to 90 mph during the storm. They found that 52 of the 54 broken trees had internal decay. Using formulas proposed by Wagener and modified by the Bartlett Tree Lab, strength loss values of broken trees with decay varied from one to

90 with an average of 33. This evidence supports the establishment of a threshold value between 30 and 40 depending on local conditions.

The F. A. Bartlett Tree Expert Co. uses a value of 33 as the maximum strength loss to be tolerated. The threshold is reduced in:

- Leaning Trees
- Trees with inherently weak or brittle wood
- Trees in exposed locations
- Trees with large/full crowns
- Declining trees
- Trees with multiple defects
- Trees in high use areas (sensitive target areas)

STRENGTH LOSS VALUE SIMPLIFIED

The minimum thickness of sound wood surrounding heart rot must be at least 15% of the total wood diameter or the tree is considered an unreasonable risk.

The thickness of sound wood must be greater in trees with cavity openings, species with weak wood, trees with multiple defects, relatively large crowns, leaning stems and trees on exposed sites.

Minimum thickness sound wood =
Wood diameter x .015

Wood Diameter (inches)	Minimum Thickness of Sound Wood (inches)
10"	1.5"
15"	2.3"
20"	3.0"
25"	3.8"
30"	4.5"
35"	5.3"
40"	6.0"
50"	7.5"

ROOT DEFECT EVALUATION

Up to seventy-five percent of all tree failures are due to root problems. The majority of tree failures occur when winds exceed 50 mph (e.g. hurricane, tornado), however,

failures may occur under any wind conditions if the roots are sufficiently weakened. Two types of failure have been classified for this occurrence: Root failure and Ground failure.

Ground failure is extremely difficult to predict. Failure occurs when the soil does not have enough strength to keep the roots intact. Soil and roots are exposed when the tree falls over. This type of failure can occur in any soil texture if the soil is wet. Failure is more common on sandy textured and very shallow (<2' deep) soils. Soil failure also occurs when trees are surrounded by pavement, which does not allow the root system to develop sufficiently to support the tree.

Root failure occurs when roots break, thus do not provide the necessary support. Root failure occurs more readily on trees, which have root decay or other root problems.

Trees growing in stands, recently thinned stands and recently created edge trees are more susceptible to windthrow due to lack of root spread and increased susceptibility to root disease. Root disease can be detected, however, this is a relatively difficult procedure.

SYMPTOMS OF ROOT FAILURE

Trees with extensive root decay often show little or no symptoms of decline. External indicators of root decay include:

- Dead (loose bark) on the roots, root flare or lower trunk.
- Fungus fruiting structures around the root flare. These include mushrooms, conks and bracts on or immediately adjacent to the tree.
- Oozing from the root flare, lower trunk or wounds on the lower trunk.
- Cuts or fill soil moved beneath the tree.
- Cracks in the soil above or beside major roots.

ASSESSING ROOT DECAY

Root decay is difficult to assess since it starts on the lower section of the root and works its way upward. The most visible section of the root shows the least amount of symptoms. When root decay is present in the buttress or flare roots it is usually



Typical pattern of root decay, starting from the lower side working upward

much more extensive than anticipated. Where root decay is suspected, the first step is to excavate soil from the root collar. Using a penknife, nick the bark on major root flares and valleys between flares to determine whether the bark is healthy.

High-risk trees may tolerate a lower percentage of root decay.

High-risk trees include the following:

1. Leaning trees
2. Trees with limited root space
3. Trees at the edge of recently cleared areas where severe windstorms frequently occur
4. Trees with large and/or dense crowns
5. Trees, which have, soil fractures associated with one or more major roots where trees are high risk and any root decay is encountered, always notify the property owner of the increased risk window. Removal may be appropriate.

The next step is to determine if decay is present in the roots or base of the trunk.

Using a drill with 1/8" x 8" bit or increment borer, drill downward into each major root issuing from the root collar. Consider the entire root decayed if any defect is encountered. Repeat the same procedures drilling toward the center of the tree in the valleys of the root collar to determine if basal decay is present. Often lower trunk heart rot is associated with root decay. Record the number of healthy and decayed roots.

ROOT DECAY THRESHOLD

Assessing root decay is complicated by the fact that root and basal decay is frequently more severe than detection procedures will indicate. Subsequently, whenever any root/basal decay is encountered the property owner should be advised that root disease might be more severe than anticipated. There is always a risk of failure (windthrow) when root decay is encountered.

The F. A. Bartlett Tree Expert Co. considers that whenever 33% or more of the major roots contain decay, the bark/cambium is dead on more than 33% of the root flare, or when 33% or more of the support root system has been severed, there is high risk of failure. Removal is recommended in the following instances.

INSPECTION AND DOCUMENTATION

Landscape trees should be periodically inspected for defects and other potentially hazardous conditions. Inspections should be performed at least annually and after major storms. Trees growing in high use sites and those with known defects should be inspected more often.

Inspections should be documented in writing whether the trees are considered defective or not. Documentation of inspections (including date), the presence of defects and recommended treatments should be sent to the property owner in writing.

When assessing wood decay and root defects, arborists should not base treatments or removal recommendations

solely on strength loss value or percentage of roots with decay. Document all qualitative parameters that may contribute to the hazard as well as the quantitative measurements. Qualitative parameters include species characteristics, crown size, defect location, multiple defects, tree vitality, site exposure, and intensity of site use (target considerations).

Literature Cited

1. Wagener, W.W. 1963. *Judging Hazards From Native Trees in California Recreation Areas: A Guide for Professional Foresters*. US Forest Service Research Paper PSW-P1. 29 pages.
2. Smiley, E.T. and B.R. Fraedrich. 1992. Determining Strength Loss From Wood Decay. *Journal of Arboriculture* 18:201-204.

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November 2, 2007

nikyoung kim design
338 Harvard Street, 300
Brookline MA 02445

Attention: Mr. William Thomas Madden

Reference: Chapel Hill Streetscape Design

Dear Bill,

RMF has been gathering and analyzing information on the existing street and sidewalk lighting system on Franklin and Rosemary Streets. Enclosed, please find the current Duke Energy pole lighting options, as requested by Emily Cameron for the Town of Chapel Hill review. A couple of points we would like to make before discussing our findings on the current lighting system.

1. We did not press for clarification during our meeting regarding why Mayor Pro Tem Bill Strain was "underwhelmed" about the current sidewalk lighting standard. If we could get further information on that and how to rate those comments, we would better know what our goal is.
2. In terms of implementing a new lighting standard for the Town of Chapel Hill, it is our recommendation that the current lighting standard be first examined for its style and how it fits in with the overall aesthetic goals the town would like to achieve. The Lancelotti fixture, in our opinion, has neither an overly traditional aesthetic nor an overly contemporary appeal. If a decision were made to stay in this transitional direction, the current fixture is a very good choice. It performs well given the appropriate parameters, it is broadly appealing and a standard has already been established in this direction.

Existing Lighting System

1. The decorative Lancelotti fixtures have 175W mercury vapor (MV) lamps in them, as originally installed by Duke Energy (MV was their standard at the time). Some of the lamps appear to be clean and others are coated in aged glaze but reduced light output. More than likely, some of the lamps have gone beyond their rated life but continue to cycle. The fixture ballasts are intended for 175W metal halide (MH) lamps although MV will work with them. By comparison 175W MH lamps have about 1/3 more light

nights than the same sized MV lamps. Duke no longer installs fixtures with MV lamps but will continue to re-lamp existing fixtures with MV until the lamps are no longer available. Duke only supplies 100W MH and 400W MH lamps at this time and does not foresee supplying other wattages any time soon. Because these fixtures are owned by Duke Energy, the 175W MV lamp will continue to be used in the foreseeable future. Even if Duke agreed to re-lamp with the 100W MH lamp (slightly more lumen output than the 175MV lamp), they would have to agree to change out all of the ballasts. The 400W MH is too much light for the decorative fixture. One topic that deserves consideration is whether the Town chooses to continue leasing fixtures from Duke Energy knowing the limitations of their current lamping, cost of leasing versus owning, etc.

2. The utility cobrahead fixtures mounted at 30' above grade have 400W high pressure sodium lamps in them.

Lighting Criteria

1. Lighting levels are generally measured in three different sets of recommended or required criteria:
 - Average maintained lighting levels on the work plane, so, if we measured a horizontal grid on a section of the street or sidewalk and looked at the *overall average number* for the horizontal levels, it should not fall below the numbers below as applicable.
 - Vertical lighting level requirements are for facial recognition of threatening individuals, etc. and the same principles for the horizontal measurements apply.
 - Uniformity measurements are for the purpose of providing even illumination without overly bright or overly dark areas.
2. NCDOT street lighting requirements:
 - West Franklin: 1.4 horizontal foot-candles average maintained, 4:1 average to minimum design uniformity
 - East Franklin: 1.2 horizontal foot-candles average maintained, 3:1 average to minimum design uniformity.
3. The Illuminating Engineering Society of North America (IESNA) sets the standard used in the United States for interior and exterior illumination in Recommended Practice 8 (RP-8-04-Reaffirmed 2005 Roadway Lighting). Since *Rosemary Street* is not under the jurisdiction of NCDOT, there are two options in setting a standard for lighting levels:
 - Follow the NCDOT requirements for either East or West Franklin.
 - Follow IESNA recommendations. Recommended Illuminance values for a commercial collector roadway with a mixed diffuse and specular asphalt road surface

- a. 1.2 horizontal foot-candles on the road surface
 - b. 1 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
4. For "pedestrian walkways", IESNA (RP-8-00) recommends the average maintained lighting levels to be:
 - High pedestrian conflict walkways where there are no barriers or separation between walkways and streets:
 - a. 2 horizontal foot-candles on the walking surface
 - b. 1 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 - High pedestrian conflict walkways with adequate separation but continuous conflict such as intersections and driveways:
 - a. 1 horizontal foot-candles on the walking surface
 - b. .5 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 - Medium pedestrian conflict walkways with fewer conflicts:
 - a. .5 horizontal foot-candles on the walking surface
 - b. .2 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 5. Other local towns have lighting ordinances but they concentrate primarily on off-street lighting applications such as canopy lighting, light trespass from one individually owned property to neighboring properties and streets, etc.
 6. As a reference due to proximity and/or nature of the surroundings:
 - UNC Chapel Hill walkway and street lighting guidelines: references IESNA recommendations as a minimum.
 - NCSU walkway and street lighting guidelines. These numbers are quite high compared with minimum IESNA recommendations:
 - a. Campus walkways (all campus pedestrian levels shall average 2.5 foot-candles, uniformity not more than 4:1; no walkway area less than 1 foot-candle.
 - b. Campus streets light levels shall average 3 foot-candles, uniformity not more than 5:1; no area less than 1 foot-candle.

Performance of the Existing Lighting System

1. Based upon preliminary *computerized lighting calculations* using the current design strategy with the 15' decorative luminaire fixture with 175W MV lamp and the 30'

cebrahead fixtures with 400W HPS lamp, the current street and sidewalk lighting standard *appears* to be adequate for illumination that meets all of the NCDDOT and IESNA criteria above. The average to minimum uniformity ratios on the sidewalks *appear* to be adequate in the computerized calculations but, in fact, are *not* in some aerial lighting levels samples taken on site. Although we have not measured lighting levels on Franklin or Rosemary Street surfaces, the current pole standard spacing for the 30' poles appears to meet or exceed the NCDDOT requirements.

Recommendations

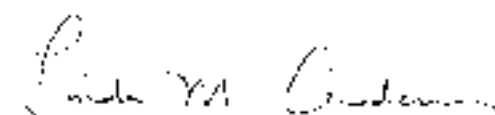
1. Re-lamp: If the Town of Chapel Hill owned the fixtures, we would recommend changing from the 175W MV lamps to the originally intended 175W MH lamps. At the very least, a conversation should take place between the Town of Chapel Hill and Duke Energy to determine how many of the lamps installed have reached the end of their rated life and how many should be replaced with new MV lamps.
2. Cost Analysis: If it is deemed within reason for the Town of Chapel Hill to take ownership of the current lighting systems on both Franklin and Rosemary Streets, consider having a cost analysis performed indicating the financial feasibility (first costs, payback, etc.) of purchasing the existing fixtures and re-lamping them with the recommended MH lamps.
3. Tree Maintenance: The best feasible and immediate low cost option for improving current lighting performance where the current standard fixtures are installed would be to address tree growth. Tree trimming and sensitive future tree specification and placement would help the uniformity ratios a great deal.
 - For current locations where fixtures are not visible due to canopy cover, trim the canopy higher and/or narrower.
 - For future tree installations, consider a narrower ovate shape that doesn't compete with the lighting.
 - With the current low canopies and wide growth on the trees, one option would be to reduce the spacing on the 15' pole assemblies to improve lighting uniformity on the sidewalks. RMF does not have a new spacing recommendation at this time but will develop that if needed as we have further communications. Reduced spacing will result in higher first costs and maintenance costs. This would change the current infrastructure and more poles taking up space means less space for other sidewalk components (trees, shrubs, walking surface, etc.). At this time, we do not recommend this option.
4. Illumination Levels: For the sidewalks, lighting level expectations need to be established to compare with what is recommended by the IESNA (see above).
 - RMF recommends following, at a minimum, the second IESNA category (1 horizontal foot candle average maintained) for sidewalks on Franklin Street but to

- also consider achieving closer to the first category (2 horizontal foot-candles average maintained) for security and safety reasons.
 - For Rosemary Street, we recommend following the same path as Franklin Street for 2 reasons: the evolving nature of the neighborhood towards a more commercial environment and continuity of the design strategy.
5. Sag Lanes on Lanes Dunes decorative fixture: The option of changing to a sag arm on the current decorative fixture (requires changing the lamp orientation and the reflector housing) results in no significant benefit for this application.
 6. New Lighting Standard: RMF is happy to assist mkyoung.kim@design in establishing a new lighting standard should the Town of Chapel Hill find cause to choose this option. In that event, it would seem most prudent to explore either a more contemporary style or a more traditional style, by comparison with the current transitional appeal, which is well represented in its category.

In conclusion, RMF is prepared to proceed in the direction most desirable in an effort to achieve a satisfactory lighting system that functions well and naturally integrates with mkyoung.kim@design's goal of establishing a lasting and consistent visual identity. Please advise us of your thoughts on these recommendations.

Very truly yours,

RMF ENGINEERING, INC.



Linda M. Anderson, LEU, LEED AP, Member, IESNA
Lighting Designer

DATE 11-2-07



March 25, 2008

mikyoun kim design
33a Harvard St no.300
Brookline MA 02445

Attention: Mr. William Madden

Reference: Chapel Hill Streetscapes Lighting

Dear Bill,

We have contacted the manufacturer of the existing 175-watt pedestrian lighting fixture, Lumec, about the possibility of replacing the existing 175-watt mercury vapor (MV) lamp/ballast with an LED type system. By coincidence, Lumec was just introducing a retro-fit 96-LED Light Engine (LLE) system for installation in the Lumec-Domus pedestrian fixtures. These are the pedestrian sidewalk fixtures that are currently installed along Franklin Street. The LLE is rated at 105-watts and the existing Lumec-Domus 175-watt MV is rated at 200-watts power consumption. The LLE system is 50% more efficient when installed in the Lumec-Domus fixture as compared to using the 175-watt MV lamp in the same fixture, thus you get more light output with the LLE using less watts. The LLE package is a bit 'pricey' in that the retro-fit package is \$825 per fixture and a complete fixture equipped with the LLE system is \$2,400. It is our understanding that Lumec will offer the same LLE package for the Lumec-Capella series fixtures by the end of 2008 with the light output being identical to that of the Lumec-Domus pedestrian fixtures. For all intents and purposes both fixtures will produce the same illumination on the sidewalk if using the identical lighting layout.

We contacted Duke Energy and discussed the possibility of Duke Energy providing the Lumec-Domus fixtures equipped with the LLE system and received a less than enthusiastic response to this idea. What they now offer is a very limited selection of either a 100-watt High Pressure Sodium (HPS) or 100-watt Metal Halide (MH) lamps as replacements for the 175-watt MV lamp. Using 100-watt lamps as replacements for the 175-watt lamps would require the ballasts to be changed out to accommodate the different characteristics of the 100-watt lamps. By changing from the 175-watt MV lamp to the 100-watt MH lamp the illumination levels will improve slightly for the existing fixture locations due to the 100-watt MH lamp lumen output being roughly 10% more than the 175-watt MV lamp. Additionally, there is some economy/energy savings due to the lower wattage of the 100-watt MH lamp. So you will increase the illumination and save energy by using the 100-watt MH lamps versus the 175-watt MV lamps on a one-for-one replacement basis. We gathered from the conversation that Duke Energy wasn't too interested in going down the LED road probably due to requirements of having to stock yet another type lamp assembly. They have really standardized on the 100-watt HPS and MH lamps for pedestrian illumination and the 400-watt HPS for street lighting. Unless the City of Chapel Hill can convince Duke Energy to purchase the LLE system it may not be a viable option unless the City would consider buying the lighting system and having it installed by a contractor, thus owning the lighting system.

In any case, whether you do a one-for-one replacement using the LLE package or the 100-watt MH lamp

RMF Engineering, Inc. 4309 Emperor Blvd. Ste. 325 Durham, NC 27703 Phone: 919-941-9876 Fax: 919-941-9957

William Madden, AIA
Chapel Hill Streetscapes Lighting

Page 2

and ballast replacement, you will still need to supplement the existing lighting system with additional fixtures to meet the recommendations of the IESNA. These supplemental fixtures will offset the reduction in power that you will gain from either of the two scenarios described above. We have addressed this in our recommendations.

Our recommendations are based upon: existing field surveys conducted by our office; IESNA recommended lighting levels; information supplied to us by Lumec lighting; meetings with Mikyoung Kim; and by information supplied to us by Duke Energy. We have taken the 'save what you have' approach per our meeting with you in that we have strived to utilize the existing pole/light locations and fixtures wherever possible and supplement these locations with new pole/lights where required to meet the code requirements as opposed to a totally new design without regard to existing pole/fixture locations. This approach also minimizes any new underground circuitry that would be required for new pole/light locations.

Existing Lighting System

1. The pedestrian way (sidewalks) illumination is provided by existing Lumec-Domus fixtures that are mounted approximately 16' above grade and have 175-watt mercury vapor (MV) lamps, as originally installed by Duke Energy (MV was their standard at the time). Some of the lamps appear to be clear and others are coated (reduced glare but reduced light output). More than likely, some of the lamps have gone beyond their rated life (24,000-hrs) but continue to cycle but at a lower light output due to lamp lumen depreciation overtime.
2. The Lumec-Domus fixture ballasts are intended for 175-watt metal halide (MH) lamps although MV will work with them. Duke no longer installs fixtures with MV lamps but will continue to re-lamp existing fixtures with MV until the lamps are no longer available. Duke only supplies 100-watt MH or HPS and 400-watt HPS lamps at this time and does not foresee supplying other wattages any time soon. Re-lamping with the 100-watt MH lamp will require a change out all of the ballasts.
3. There are some 'Cobra Head' type fixtures mounted approximately 16' above grade that are utilized for pedestrian way lighting. It is assumed these are equipped with 175-watt MV lamps.
4. The utility 'Cobra Head' fixtures utilized for the street illumination are mounted at 30' above grade and have 400-watt HPS lamps installed.

Lighting Criteria

1. Lighting levels are generally measured in three different sets of recommended or required criteria:
 - A. Average maintained lighting levels on the work plane, so, if we measured a horizontal grid on a section of the street or sidewalk and looked at the *overall average number* for the horizontal levels, it should not fall below the numbers below as applicable.
 - B. Vertical lighting level requirements are for facial recognition of threatening individuals, etc. and the same principles for the horizontal measurements apply.
 - C. Uniformity measurements are for the purpose of providing even illumination without overly bright or overly dark areas.
2. NCDOT *street* lighting requirements:

RMF Engineering, Inc. 4309 Emperor Blvd. Ste. 325 Durham, NC 27703 Phone: 919-941-9876 Fax: 919-941-9957

- A. West Franklin: 1.4 horizontal foot-candles average maintained, 4:1 average to minimum design uniformity
 - B. East Franklin: 1.2 horizontal foot-candles average maintained, 3:1 average to minimum design uniformity.
3. The Illuminating Engineering Society of North America (IESNA) sets the standard used in the United States for interior and exterior illumination in Recommended Practice 8 (RP-8-00-Reaffirmed 2005 Roadway Lighting). Since Rosemary Street is not under the jurisdiction of NCDOT, there are two options in setting a standard for lighting levels:
- A. Follow the NCDOT requirements for either East or West Franklin.
 - B. Follow IESNA recommendations. Recommended illuminance values for a commercial collector roadway with a mixed (diffuse and specular) asphalt road surface:
 - a. 1.2 horizontal foot-candles on the road surface
 - b. 1 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
4. For "pedestrian walkways", IESNA RP-8-00 recommends the average maintained lighting levels to be:
- A. High pedestrian conflict walkways where there are no barriers or separation between walkways and streets:
 - a. 2.0 horizontal foot-candles on the walking surface
 - b. 1.0 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 - B. High pedestrian conflict walkways with adequate separation but continuous conflict such as intersections and driveways:
 - a. 1.0 horizontal foot-candles on the walking surface
 - b. 0.5 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 - C. Medium pedestrian conflict walkways with fewer conflicts:
 - a. 0.5 horizontal foot-candles on the walking surface
 - b. 0.2 vertical foot-candle at 4.9' above the walking surface
 - c. Average to minimum design uniformity of 4:1
 - D. Recommended Illumination Levels: We recommend and have used in our calculations the following Illumination levels to meet the recommendations of the IESNA (see above):
 - a. 1.0 horizontal foot-candle average maintained for sidewalks on Franklin Street.
 - b. For Rosemary Street and those streets connecting Franklin with Rosemary, we recommend following the same as Franklin Street, 1.0 horizontal foot-candle average maintained, for 2 reasons:
 - i. The evolving nature of the neighborhood towards a more commercial environment.
 - ii. Continuity of the design strategy.
5. As a reference due to proximity and/or nature of the surroundings:

- A. UNC-Chapel Hill walkway and street lighting guidelines: references IESNA recommendations as a minimum.
- B. NCSU walkway and street lighting guidelines. These numbers are quite high compared with minimum IESNA recommendations:
 - a. Campus walkways (all campus paths) light levels shall average 2.5 foot-candles; uniformity not more than 4:1; no walkway area less than 1.0 foot-candle.
 - b. Campus streets light levels shall average 3.0 foot-candles, uniformity not more than 5:1, no area less than 1.0 foot-candle.

Performance of the Existing Lighting System

1. Based upon *computerized lighting calculations* using the current design strategy with the 16' decorative Lumec-Domus fixture equipped with 175-watt MV lamp and the 30' 'Cobra head' fixtures with 400W HPS lamp:
- A. In our opinion, the current street illumination levels meet the NCDOT and IESNA criteria above.
 - B. In our opinion, the current sidewalk illumination levels do not meet the IESNA criteria.
 - a. The low illumination levels predominantly occur along the Rosemary Street corridor and in a few areas along the connector streets between Rosemary and Franklin Streets, and along the southern part Franklin Street.

Recommendations

1. Tree Maintenance: The first recommendation for improving current lighting performance where the current standard fixtures are installed would be to address tree growth. Tree trimming and sensitive future tree specification and placement would help the uniformity ratios a great deal. Additionally, this tree maintenance should be performed in harmony with the lighting options recommended and contained herein.
- A. For current and/or future locations where fixtures are not or will not be visible due to canopy cover, trim the canopy higher and/or narrower.
 - B. For future tree installations, consider a narrower ovate shape that doesn't compete with the lighting.
2. Illumination Recommendations: Either of these options will improve the existing pedestrian illumination levels and will meet the recommended illumination levels as set forth by the IESNA. They will also establish the lighting fixture standard to be used for future upgrades to pedestrian way areas. These recommendations are shown on Drawings E200.01, E200.02 and E200.03.
- A. Option No. 1 (Re-lamp w/100-watt MH + Add New)
 - a. Re-lamp all existing Lumec-Domus fixtures with the 100-watt MH lamps including replacing the ballasts. The illumination levels for the existing pedestrian fixture locations will be increased by roughly 10% versus the same location using a new 175-watt MV lamp.
 - b. Replace all 'Cobra-Head' fixtures that are being utilized to illuminate pedestrian ways (mounted at 16' above grade) with the Lumec-Domus fixture equipped with 100-watt

MH lamps.

- c. Install new pole/lighting fixtures to supplement the existing pedestrian lighting system illumination levels in areas that are below the minimum IESNA recommended illumination levels. The new lighting fixture locations will utilize the Lumec-Domus pedestrian lighting fixtures equipped with 100-watt MH lamps and will be mounted at 16-ft above the sidewalk level, similar to what already exists in the commercial corridor on Franklin Street between Henderson and Columbia Streets.
 - d. The **net increase** in power requirements for this option will be approximately 6,090-watts.
 - e. Our opinion of probable material cost for Option No. 1, not including any wiring or conduit installation, is \$352,000.00.
- B. Option No. 2 (Retro-fit with LLE (LED) package + Add New).
- a. Replace all existing 175-watt mercury vapor (MV) lamps that are currently installed in the Lumec-Domus fixtures with the Lumec LLE (LED) lighting system. The illumination levels for the existing pedestrian fixture locations will be increased by roughly 40% versus the same location using a new 175-watt MV lamp.
 - b. Replace all 'Cobra-Head' fixtures that are being utilized to illuminate the pedestrian ways (mounted at 16' above grade) with the Lumec-Domus fixture equipped with the LLE lighting system.
 - c. Install new pole/lighting fixtures to supplement the existing pedestrian lighting system illumination levels in areas that are below the minimum IESNA recommended illumination levels. The new lighting fixture locations will utilize the Lumec-Domus pedestrian lighting fixtures equipped with the LLE lighting system and will be mounted at 16-ft above the sidewalk level, similar to what already exists in the commercial corridor on Franklin Street between Henderson and Columbia Streets.
 - d. The **net gain** in power requirements for this option will be approximately 4,830-watts.
 - e. Our opinion of probable material cost for Option No. 2, not including any wiring or conduit installation, is \$555,000.00.

We are ready to meet with Duke Energy to discuss the options and their probable cost to install each option although we have heard from Lynne Blalock of Duke Energy that Duke Energy is meeting with the City of Chapel Hill on March 26, 2008 to discuss the street/sidewalk lighting system and what options are available from Duke Energy.

Very truly yours,

RMF ENGINEERING, INC.



James L. Wise Jr., PE
Associate



December 30, 2008

mikyoung kim design
33a Harvard St no.300
Brookline MA 02445

Attention: Mr. William Madden

Reference: Chapel Hill Streetscapes Lighting

Dear Bill,

From our telephone conversation today and with this letter we are modifying our recommendations from our last letter to you dated March 25, 2008. We have attached that letter for your reference.

Recommendations

1. Re-lamp: We recommend changing from the 175W MV lamps to the originally intended 175W MH lamps for the existing Lumec-Domus lighting fixtures that are presently installed along Franklin Street between Henderson and Columbia Streets. The light output from the Lumec-Domus will increase approximately 50% based upon published lamp data for the 175 MV and 175 MH lamps. The existing pole spacing is adequate to produce the desired illumination provided the lighting is not being blocked.
2. Tree Maintenance: To improve the lighting fixture performance where the current standard fixtures are installed the tree growth needs to be addressed. Tree trimming and sensitive future tree specification and placement would help the uniformity ratios a great deal.
 - For current and/or future locations where fixtures are not or will not be visible due to canopy cover, trim the canopy higher and/or narrower.
 - For future tree installations, consider a narrower ovate shape that doesn't compete with the lighting.
3. Street Side Retail Awnings: There are presently several retail awnings that protrude far enough out onto the sidewalk area that illumination from the existing Lumec-Domus fixtures is partially blocked along the sidewalk at the retail storefront.
 - A workable solution for both the retailer and the city would seem as simple as the retailer providing the same illumination under the awning as would be produced by the pedestrian lighting system if that system were not blocked by the awning. The illumination achieved and the quality of the lighting would be somewhat subjective to the eye of the beholder unless the city is prepared to measure lighting levels and examine the fixtures and lamps on a regular basis. We do not have a viable solution for this and are hesitant in suggesting the city enact an ordinance since this usually creates more problems than it solves. All

interested parties should meet to discuss amicable solutions for the lighting under the awnings.

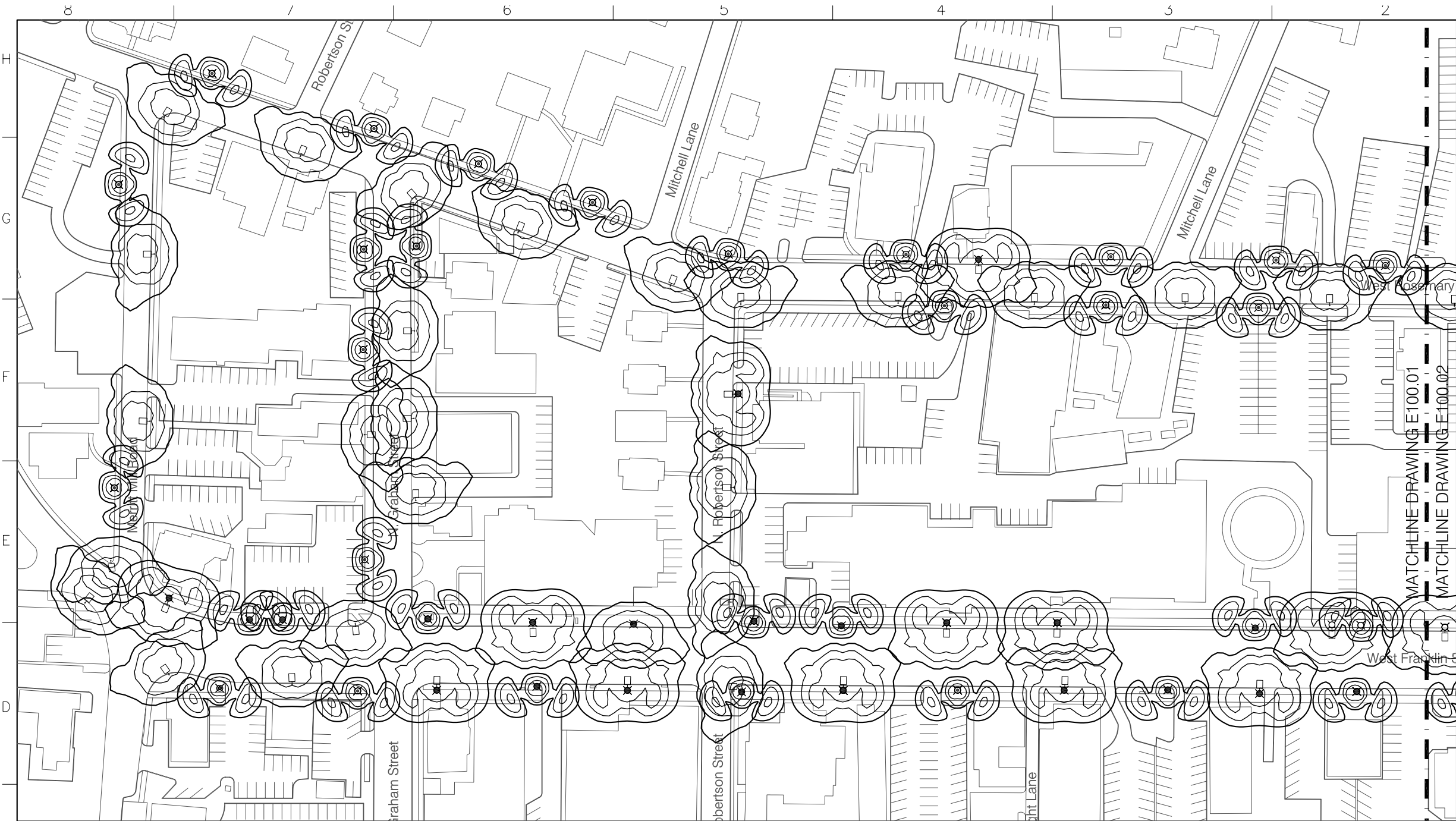
4. Supplemental Lighting from Retail Stores: The following is our opinion and since it addresses legal and liability issues it should be fully discussed with the city attorney before proceeding to enact any type of ordinance.
 - There have been discussions about the retail community possibly providing supplemental illumination (not associated with the awnings as described above) along there respective storefronts to help increase the overall general illumination on the sidewalk area. While this may seem to have merit on face value, and indeed would help the illumination along the sidewalk areas, we do not recommend this as a solution for low illumination levels on the sidewalk. It would appear to us that whoever is responsible and liable for properly illuminating the sidewalks should first and foremost provide the proper illumination for the sidewalk. Supplemental lighting would be above and beyond this illumination level.
 - Relying on retail supplemental lighting to bring the illumination levels into compliance with the recommendations of the Illuminating Engineering Society would create a level of false security due to the retailer's right to remove the lighting without notice, or, if the retailer fail to maintain the lighting system in proper operating condition. This would leave whoever has the responsibility and thus the liability to illuminate the sidewalk area, open to a lawsuit should anyone be injured due to low lighting levels.

If you should have any questions please feel free to call us.

Very truly yours,

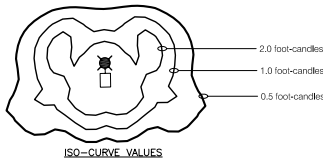
RMF ENGINEERING, INC.

James L. Wise Jr., PE
Associate



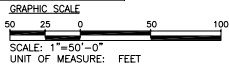
MATCHLINE DRAWING E100.01
MATCHLINE DRAWING E100.02

Calculation Summary									
Project: Chapel Hill Duke Power Co. (33759) MB									
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min	LDRatio	
Sidewalk Robertson Street	Illuminance	FC	1.90	7.8	0.5	3.80	15.60	N.A.	
Sidewalk Church Street	Illuminance	FC	1.75	16.7	0.4	4.38	41.75	N.A.	
Sidewalk Columbia Street	Illuminance	FC	2.42	12.8	0.7	3.46	18.29	N.A.	
Sidewalk Henderson Street	Illuminance	FC	2.05	10.0	0.6	3.42	17.07	N.A.	
Sidewalk Graham Street	Illuminance	FC	2.19	11.1	0.7	3.13	15.86	N.A.	
Sidewalk Merritt Hill Road	Illuminance	FC	1.17	13.2	0.2	5.85	66.00	N.A.	
Sidewalk Rosemary Street	Illuminance	FC	1.73	15.3	0.2	8.65	76.50	N.A.	
Sidewalk Rosemary Street	Illuminance	FC	1.90	14.1	0.3	5.00	47.00	N.A.	
Sidewalk Franklin Street	Illuminance	FC	2.47	16.9	0.9	2.74	18.78	N.A.	
Sidewalk Franklin Street	Illuminance	FC	2.17	16.9	0.1	21.70	169.00	N.A.	

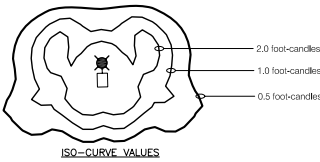
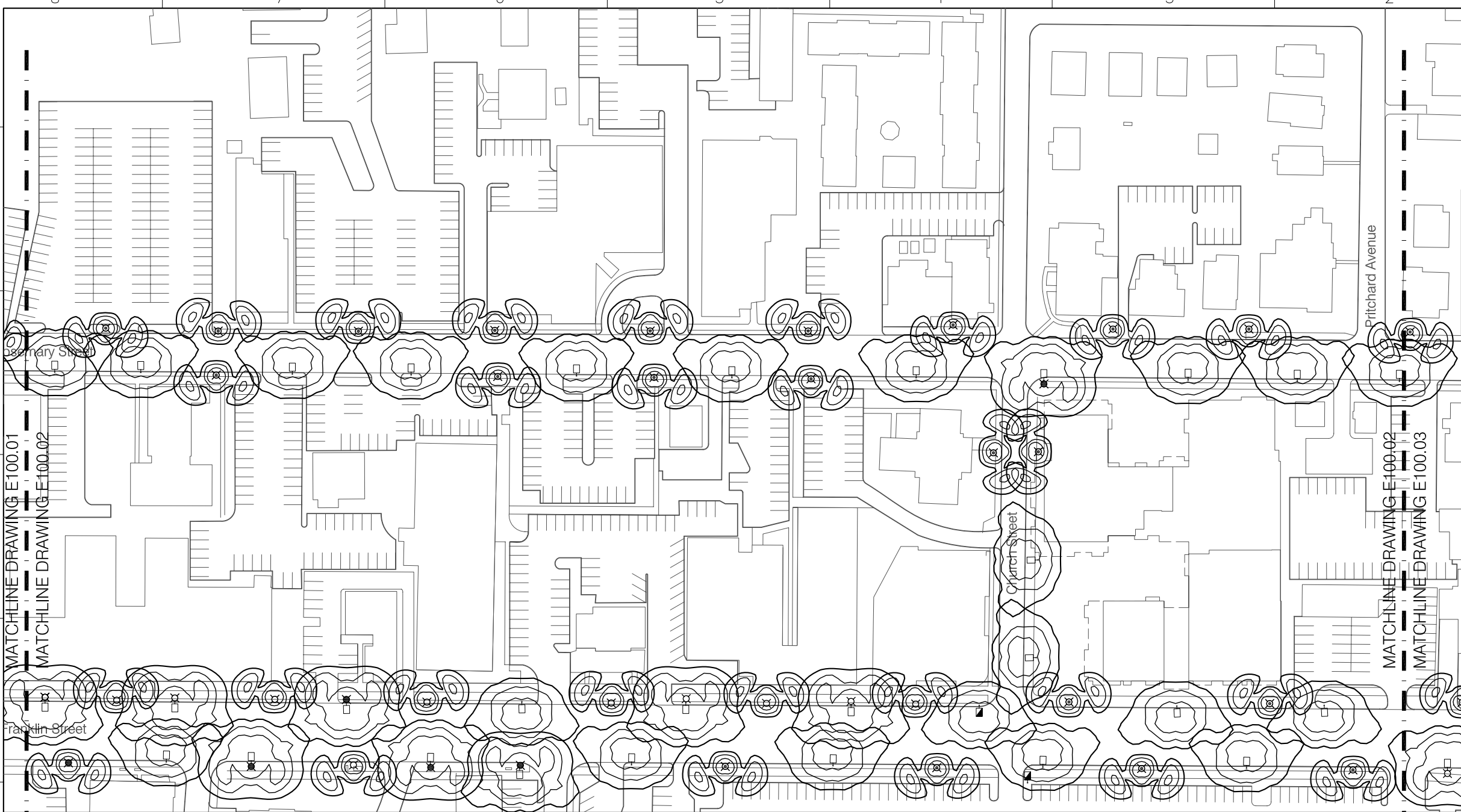


- GENERAL NOTES**
1. THIS DRAWING SHOWS BOTH NEW AND EXISTING LIGHTING FIXTURE LOCATIONS UTILIZED FOR THE ILLUMINATION OF PUBLIC ROADWAYS AND PEDESTRIAN SIDEWALKS FOR THE DESIGNATED AREAS OF THE PROJECT. LOCATIONS HAVE BEEN DETERMINED BY FIELD CONDITIONS AND ARE APPROXIMATE IN NATURE.
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LIGHTING FIXTURE LEGEND		OPTION #1	OPTION #2
	EXISTING DUKE ENERGY 400 WATT HIGH PRESS. SODIUM 'COBRA-HEAD' STYLE FIXTURE ON 30' METAL TRAFFIC SIGNAL POLE	NO WORK	NO WORK
	EXISTING DUKE ENERGY 400 WATT HIGH PRESS. SODIUM ROADWAY 'COBRA-HEAD' STYLE FIXTURE ON 30' WOOD OR METAL POLE	NO WORK	NO WORK
	EXISTING DUKE ENERGY 400 WATT HIGH PRESS. SODIUM ROADWAY 'COBRA-HEAD' STYLE FIXTURE ON 30' POLE WITH NEW PEDESTRIAN FIXTURE	INSTALL NEW LUMEC-DOMUS PEDESTRIAN FIXTURE EQUIPPED WITH 100-WATT MH LAMP AND BALLAST ON EXISTING 16' POLE AT 12' ABOVE GRADE	INSTALL NEW LUMEC-DOMUS PEDESTRIAN FIXTURE EQUIPPED WITH LLE (LED) LIGHTING PACKAGE ON EXISTING 16' POLE AT 12' ABOVE GRADE
	EXISTING DUKE ENERGY 400 WATT HIGH PRESS. SODIUM ROADWAY 'COBRA-HEAD' STYLE FIXTURE & EXISTING 175-WATT MV LUMEC-DOMUS FIXTURE MOUNTED AT 12' ON EXISTING 30' METAL POLE	RE-LAMP AND RE-BALLAST EXISTING LUMEC-DOMUS FIXTURE WITH 100-WATT MH LAMP AND BALLAST	RETRO-FIT EXISTING LUMEC-DOMUS FIXTURE WITH LLE (LED) LIGHTING PACKAGE
	EXISTING DUKE ENERGY 175-WATT MV LUMEC-DOMUS FIXTURE MOUNTED ON EXISTING 16' METAL POLE	RE-LAMP AND RE-BALLAST EXISTING LUMEC-DOMUS FIXTURE WITH 100-WATT MH LAMP AND BALLAST	RETRO-FIT EXISTING LUMEC-DOMUS FIXTURE WITH LLE (LED) LIGHTING PACKAGE
	EXISTING DUKE ENERGY 175 WATT MV 'COBRA-HEAD' FIXTURE MOUNTED ON EXISTING 16' POLE	REPLACE EXISTING 'COBRA-HEAD' FIXTURE WITH LUMEC-DOMUS FIXTURE EQUIPPED WITH 100-WATT MH LAMP AND BALLAST	REPLACE EXISTING 'COBRA-HEAD' FIXTURE WITH LUMEC-DOMUS PEDESTRIAN FIXTURE EQUIPPED WITH LLE (LED) LIGHTING PACKAGE
	NEW 16' POLE AND PEDESTRIAN LIGHTING FIXTURE	INSTALL NEW LUMEC-DOMUS PEDESTRIAN FIXTURE EQUIPPED WITH 100-WATT MH LAMP AND BALLAST ON NEW POLE. FIXTURE MOUNTED AT 12' ABOVE GRADE	INSTALL NEW LUMEC-DOMUS PEDESTRIAN FIXTURE EQUIPPED WITH LLE (LED) LIGHTING PACKAGE ON NEW POLE. FIXTURE MOUNTED AT 12' ABOVE GRADE
	EXISTING TOWN PARKING LOT METAL HALIDE FIXTURE ON WHITE POLE	NO WORK	

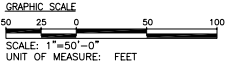


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CHECKED BY:		JFD	CLIENT JOB #:	XXX			
PROJ. MGR.:		JLW	CLIENT DWG. #:	XXX			
CHAPEL HILL STREETSCAPES							
mikyoung kim		mikyoung kim design 33a Harvard Street #300 Brookline, MA 02445 T: 617.738.9130 www.mikyoungkim.com project # MYKD5507					
RECOMMENDED LIGHTING CHANGES OPTIONS 1 & 2							
		RMF ENGINEERING, INC. 4300 EMPEROR BLVD., SUITE 325 DURHAM, NORTH CAROLINA 27312				E200.01	

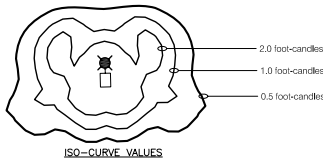
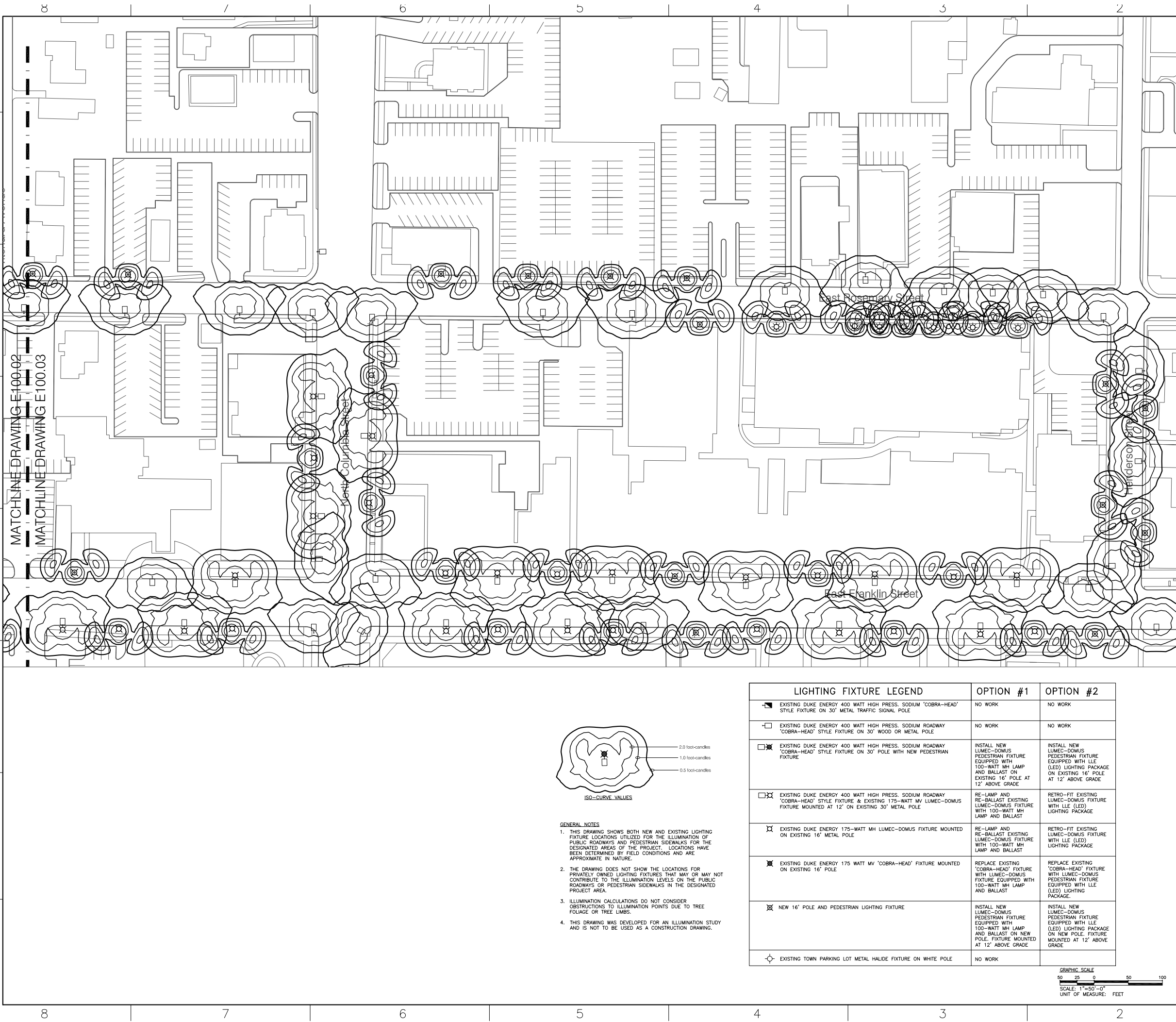


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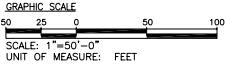


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PROJ. MGR.:		JULW	CLIENT DWG. #:	XXXX			
CHAPEL HILL STREETSCAPES							
mikyoungh kim				mikyoungh kim design 33a Harvard Street #300 Brookline, MA 02445 T: 617.738.9130 www.mikyounghkim.com project # MYKD5507			
RECOMMENDED LIGHTING CHANGES OPTIONS 1 & 2							
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				E200.02			



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mikyoung kim		<small>mikyoung kim design 33a Harvard Street #300 Brookline, MA 02445 t: 617.738.9130 www.mikyoungkim.com project # MYKD5507</small>			
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		<small>RMF ENGINEERING, INC. 4309 EMPEROR BLVD., SUITE 325 DURHAM, NORTH CAROLINA 27312</small>		E200.03	



10H00 > Boulevard



Domus Series



DMS50-SG-LD-MM

DMS50-SHA-NM

DMS50-SG-LD-NM





DMS60-SHA

Domus Series

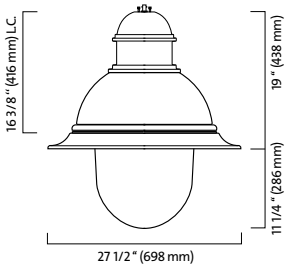
The Domus Series is one of the most versatile luminaires offered by Lumec. This classic shape was one of the first in a line of innovative Lumec designs. Encompassing most of the exclusive Lumec innovations, the Domus can fit into any environment; be it the main street of a small Alaskan village or the downtown of a high-tech center. Combined with today’s efficient optics, Domus embodies the tradition of excellence in Lumec products.

Characteristics

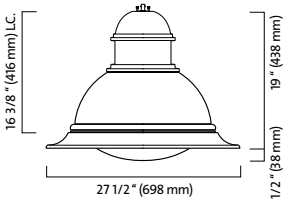
- Constructed from top-quality materials, the Domus Series maintains **excellent performance** in even the most demanding environment.
- Smartseal™** optical systems (IP66) virtually eliminate Luminaire Dirt Depreciation (LDD)
- Tool-free access** to lamp and electrical components for ease of maintenance.
- SHA and SSA optical chambers **reduce glare** by using a unique combination of reflectors and internal prism refractors.
- SCB optical chamber offers **exceptional performance** and cutoff with a combination of a hydro-formed aluminum reflector and a tempered glass lens.
- Dark-sky friendly** SG optics provide full-cutoff in five distributions.

> For the latest updates go to www.lumec.com

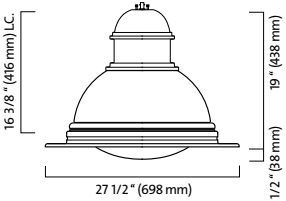
> Luminaires (Luminaires are UL and CSA approved)



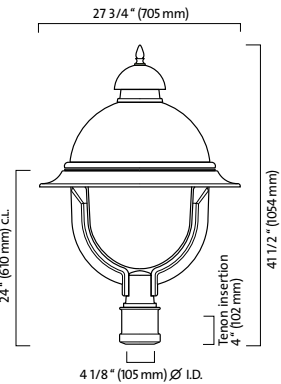
DMS50-SHA/SSA
EPA: 1.35 sq. ft.
Weight: 42 lbs (19.1 kg)



DMS50-SCB
EPA: 1.00 sq. ft.
Weight: 42 lbs (19.1 kg)



DMS50-SCB-FB
EPA: 1.00 sq. ft.
Weight: 42 lbs (19.1 kg)



DMS60-SHA
EPA: 1.82 sq. ft.
Weight: 40 lbs (18.1 kg)

> HID Lamps (High Intensity Discharge)

WATTAGE	DMS60		DMS50	
	SHA3M-PC / SCB3M SSA3M-PC	SHA3M-ACDR SSA3M-ACDR	SG	SG
50 MH, medium	✓	✓	RB	✓
70 MH, medium	✓	✓	RB	✓
100 MH, medium	✓	✓	RB	✓
150 MH, medium	✓	✓	RB	✓
175 MH, mogul	✓	✓	RB	✓
200 MH, mogul	✓	N/A	RB	✓
250 MH, mogul	✓	N/A	RB	✓
400 MH, mogul	N/A	N/A	N/A	RB RJ ¹
35 HPS, medium	✓	✓	RB	✓
50 HPS, mogul	✓	✓	RB	✓
70 HPS, mogul	✓	✓	RB	✓
100 HPS, mogul	✓	✓	RB	✓
150 HPS, mogul	✓	✓	RB	✓
200 HPS, mogul	✓	N/A	RB ¹	✓ ¹
250 HPS, mogul	✓	N/A	RB ¹	✓ ¹
400 HPS, mogul	N/A	N/A	N/A	RB ¹
✓: Available N/D: Not available RB: Remote ballast required 1: n/a with SGFM RJ: Reduced Jacket ED28 required				

> Optical systems (Lamps not included)



SHA and SSA optics

Sealed optical chamber consisting of a reflector permanently assembled on top of an internal prismatic globe.



SHA3M: Asymmetrical
SSA3M: Asymmetrical
> House shield available in option (HS)

In the above optics, the sleeve and shutter permit exact positioning of the lamp.
SHA & SSA refractors available in: **ACDR**: Acrylic (175 W max.) **PC**: Polycarbonate
Add suffix to optical system code.



SCB optics

Sealed optical chamber consisting of a reflector permanently assembled on top of a tempered-glass sag lens.



SCB3M: Asymmetrical
> House shield available in option (HS)

In the above optics, the sleeve and shutter permit exact positioning of the lamp.

> see next page for more optical systems

> Maintenance



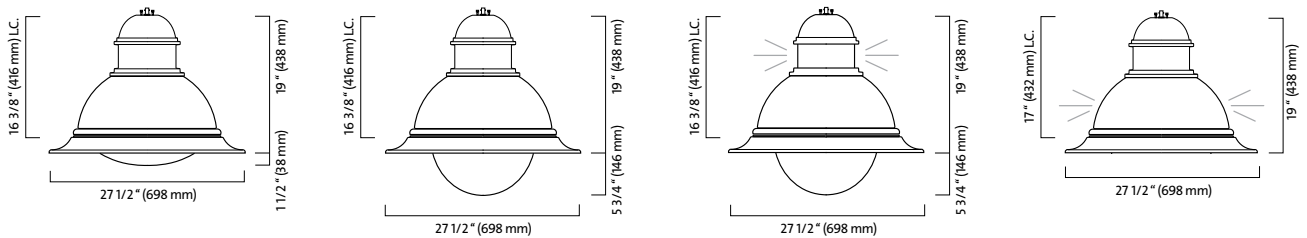
Access to internal component

The luminaire’s hood can be opened by simply applying pressure on the latch located on the technical ring. The hood can then be pivoted along a hinge incorporated in the technical ring. A built-in stopper holds the cover at 90° from the technical ring.



Access to lamp

A simple quarter-turn of the **Smartseal™** shutter provides easy access to the lamp. Quick-disconnect terminals between the lamp and the ballast tray ensure safe and easy lamp replacement.



DMS50-SG-SLG

EPA: 1.00 sq. ft.
Weight: 42 lbs (19.1 kg)

DMS50-SG-DL


EPA: 1.20 sq. ft.
Weight: 42 lbs (19.1 kg)

DMS50-SG-LR-DL

EPA: 1.20 sq. ft.
Weight: 42 lbs (19.1 kg)

DMS50-SG-LD

EPA: 1.20 sq. ft.
Weight: 42 lbs (19.1 kg)

 **SG Optics**
Segmented cut-off reflector system set in faceted arc-image duplicating patterns

SGQ: Symmetrical
SG1: Symmetrical
SG2: Asymmetrical
SG3: Asymmetrical
SGFM: Forward throw
> House shield available for SG2 and SG3

* Photometry available on Lumec web site www.lumec.com

> Options de luminaire

- FS

Fusing (consult factory)
- HS

House shield
- FB

Flat base spinning
- LD

Luminous dome,
250 W maximum
(SG optics only)
(only with DMS50)
(remote ballast
for 200 and 250 W
in bracket or pole)
- LR


Luminous ring,
250 W maximum
(SG optics only)
(only with DMS50)
(remote ballast
for 200 and 250 W
in bracket or pole)
- DL

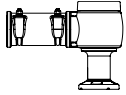
Polycarbonate drop lens,
250 W maximum
(SG optics only)
- SLPC

Polycarbonate sag lens,
175 W maximum
(SG optics only)
- SLG

Tempered glass sag lens
(SG optics only)

> Adaptors

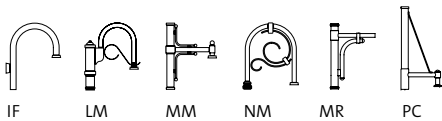
-  MA1

The luminaire is suspended by means of a mounting adaptor with a 1 1/4" (32mm) npt threaded hole accepting a threaded tube from the mounting.
(retrofit adaptor for existing mounting)
-  SMB

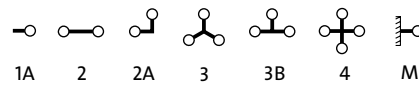
The luminaire is suspended by means of a decorative side-mounting cast-aluminium adaptor. This adaptor accepts tubes from 1 5/8" to 2 3/8" (41 to 60 mm) and is adjustable to more or less 5°.

> Mountings

(Consult the Pole Guide for details and the complete line of mountings)

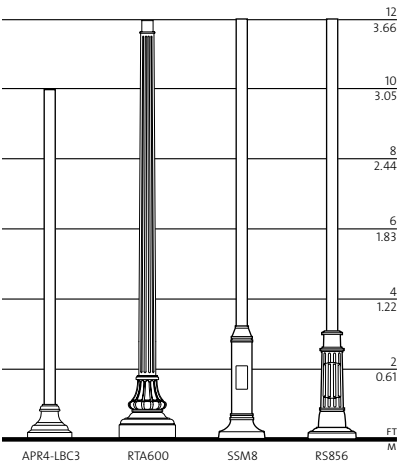


> Configurations



> Poles and Pole options

(Consult the Pole Guide for details and the complete line of poles)



> Finishes

The specially formulated **Lumital** powder coat finish is available in a range of many standard colors.
(Consult Lumec's Color Chart for complete specifications)

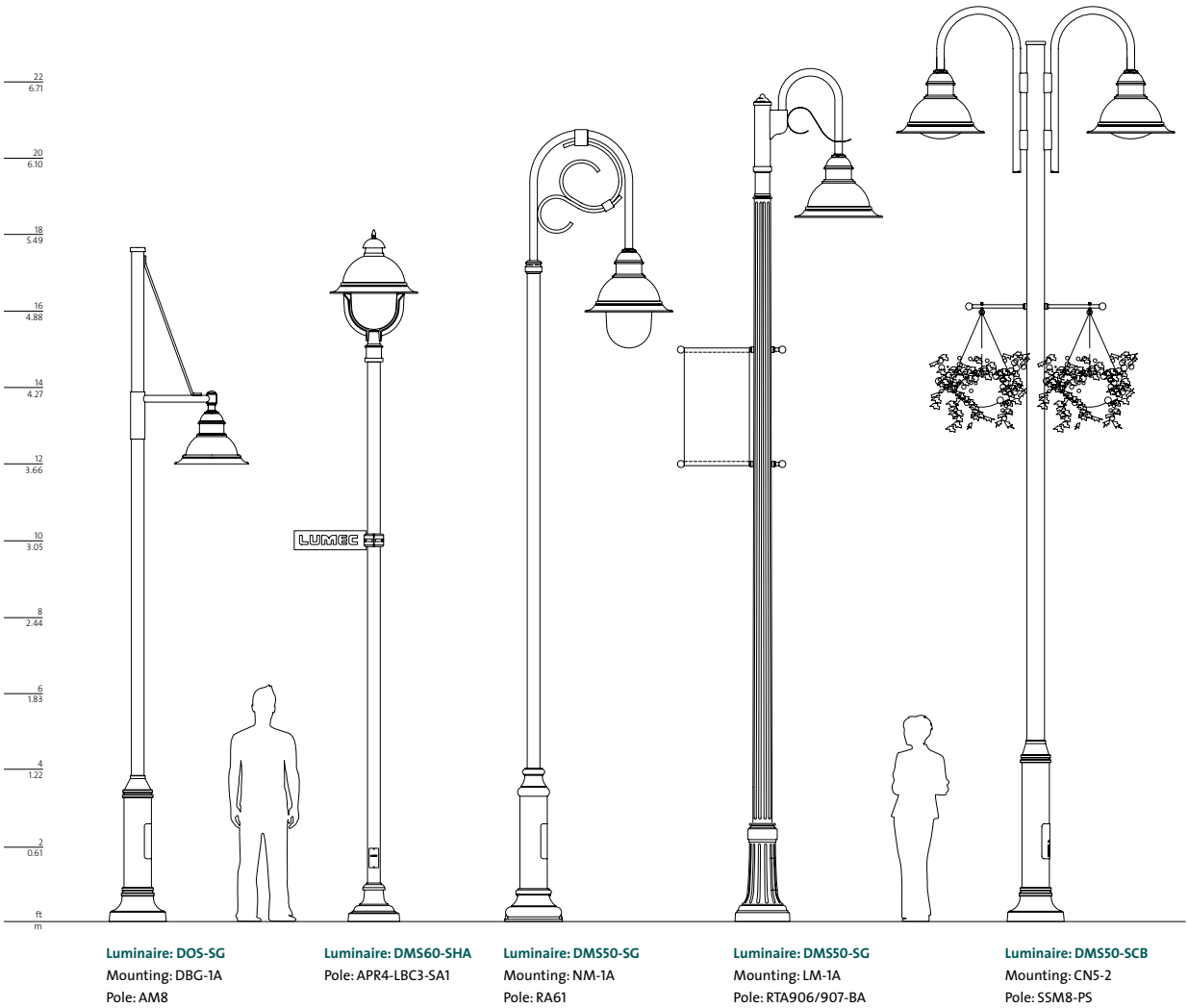
> Ordering sample

Luminaire	Lamp	Optical System	Voltage	Adaptor	Options	Mounting & configuration	Pole	Finish
DMS50	100 HPS	SHA3L-ACDR	120	SMB	FS-LR	MR-1A	R80-15	GNTX



Access to ballast

The tool-free drop-in unitized ballast tray is slipped into the post top box which rests on the optical support plate. Here again, the use of quick-disconnect terminals ensures safe and easy ballast maintenance



www.lumec.com

Lumec Head Office

640, Curé-Boivin Boulevard
Boisbriand, Québec
J7G 2A7 Canada

Tel. : (450) 430.7040
Fax : (450) 430.1453

A Genlyte Company

LUMEC

Hg

Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contains Mercury" and/or with the symbol "Hg." Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org

LUMEC

Lumec reserve the right to substitute materials or change the manufacturing process of its products without prior notification.

Registered Lumec inc.

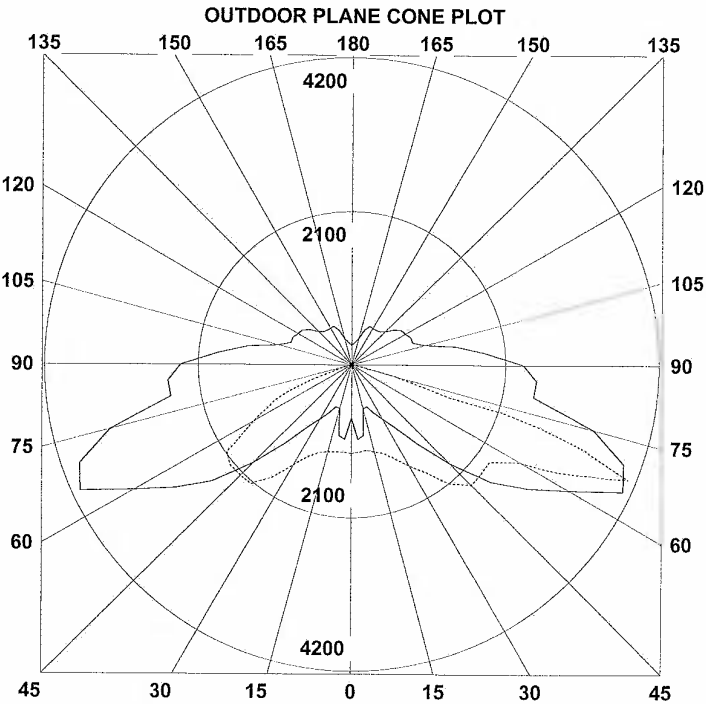
LitePro

Photometric Data Summary

LUMINAIRE: DMS50-SG3 (FLAT LENS HORIZONTAL LAMP)
[DATE] 11 July 2001 [LABORATO
LUMEC [LUMCAT] 175MH-DMS50-SG3
BALLAST:
BALLAST FACTOR: 1.00
LAMP:
LUMENS PER LAMP: 12000
WATTS: 189
CUTOFF TYPE: Cutoff
RANGE CLASS: Short Range
LUMINOUS OPENING IN FEET
LENGTH: 0.00
WIDTH: -1.22
HEIGHT: 0.00

ZONAL LUMENS			
ZONE	LUMENS	% LAMP	% FIXTURE
0-30	1069	8.9	13.7
0-40	2112	17.6	27.0
0-60	5308	44.2	67.9
0-90	7822	65.2	100.0
90-120	1	0.0	0.0
90-130	1	0.0	0.0
90-150	1	0.0	0.0
90-180	1	0.0	0.0
0-180	7823	65.2	100.0

CANDELA SUMMARY					
ANGLE	0.0	52.5	75.0	95.0	180.0
0.0	1209	1209	1209	1209	1209
15.0	1145	1158	1244	1252	1126
30.0	1063	1371	1725	1822	975
45.0	1003	2202	2312	2373	791
60.0	896	1766	2279	2339	530
67.5	729	2746	3414	1836	270
75.0	117	336	717	108	56
82.5	45	11	12	18	10
90.0	5	7	8	4	1
115.0	0	0	0	0	0
145.0	0	0	0	0	0
175.0	0	0	0	0	0
180.0	0	0	0	0	0



Vert. Plane Through 65.0-245.0 Horiz. -----
Horiz. Cone Through 67.5 Vert. -----
Max Candelas = 4084 @ 65.0H,67.5V

THIS REPORT IS BASED ON IES TEST DATA FOR A SPECIFIC LAMP/BALLAST COMBINATION. EXTRAPOLATION OF THESE DATA FOR OTHER LAMP/BALLAST COMBINATIONS MAY PRODUCE ERRONEOUS RESULTS. THE BALLAST FACTOR MUST BE APPLIED TO THE LUMEN OUTPUT RATING ASSIGNED TO THE LAMP(S) OR TO THE CANDELA VALUES SHOWN.

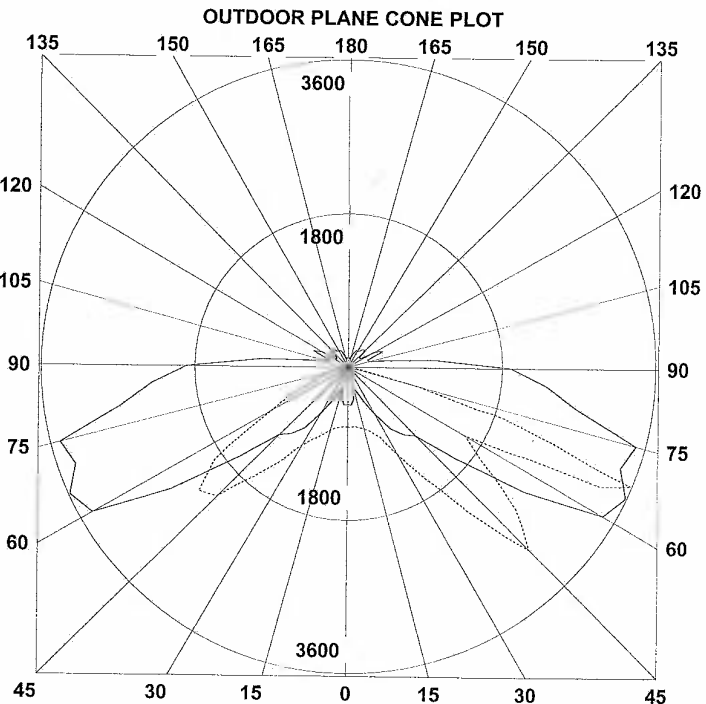
LitePro

Photometric Data Summary

LUMINAIRE:
[DATE] 12 July 2001 [LABORATO
LUMEC [LUMCAT] 100MH-DMS50-SG3
BALLAST:
BALLAST FACTOR: 1.00
LAMP: 100W MH MED BASE
LUMENS PER LAMP: 8100
WATTS: 110
CUTOFF TYPE: Cutoff
RANGE CLASS: Short Range
LUMINOUS OPENING IN FEET
LENGTH: 0.00
WIDTH: -1.22
HEIGHT: 0.00

ZONAL LUMENS			
ZONE	LUMENS	% LAMP	% FIXTURE
0-30	674	8.3	11.0
0-40	1444	17.8	23.6
0-60	4170	51.5	68.1
0-90	6120	75.6	100.0
90-120	0	0.0	0.0
90-130	0	0.0	0.0
90-150	0	0.0	0.0
90-180	0	0.0	0.0
0-180	6120	75.6	100.0

CANDELA SUMMARY					
ANGLE	0.0	52.5	75.0	95.0	180.0
0.0	702	702	702	702	702
15.0	660	724	784	783	682
30.0	559	953	1277	1236	550
45.0	588	2327	2355	2492	449
60.0	608	980	1661	1450	308
67.5	436	2228	3486	1019	109
75.0	16	452	650	50	31
82.5	0	1	7	6	0
90.0	0	0	0	0	0
115.0	0	0	0	0	0
145.0	0	0	0	0	0
175.0	0	0	0	0	0
180.0	0	0	0	0	0



Vert. Plane Through 62.5-242.5 Horiz. -----
Horiz. Cone Through 67.5 Vert. -----
Max Candelas = 3582 @ 62.5H,67.5V

THIS REPORT IS BASED ON IES TEST DATA FOR A SPECIFIC LAMP/BALLAST COMBINATION. EXTRAPOLATION OF THESE DATA FOR OTHER LAMP/BALLAST COMBINATIONS MAY PRODUCE ERRONEOUS RESULTS. THE BALLAST FACTOR MUST BE APPLIED TO THE LUMEN OUTPUT RATING ASSIGNED TO THE LAMP(S) OR TO THE CANDELA VALUES SHOWN.

LUMEC

LifeLED™ / Breathing life



> LED powered

03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 > Residential development 12:00 13:00

Lumec is a Philips group brand

PHILIPS



A NEW WORLD REVEALED BY LifeLED™

After thousands of hours of research and development, Lumec is proud to present an outdoor LED lighting system that provides the two fundamental criteria for lighting performance, intensity and uniformity. While some have suggested waiting for the next generation of LED's, Lumec proudly demonstrates that the future is now. Lumec's LED technology, LifeLED™, solves the two main industry problems regarding LED performance (uniformity and intensity), while at the same time delivering energy savings of up to 50%.

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WITH LIFELED™

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MULTI-PRODUCT
TECHNOLOGY

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RETROFIT KIT

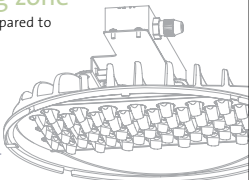
P22 > TYPICAL ROADWAY CALCULATION



WHAT IS LifeLED™

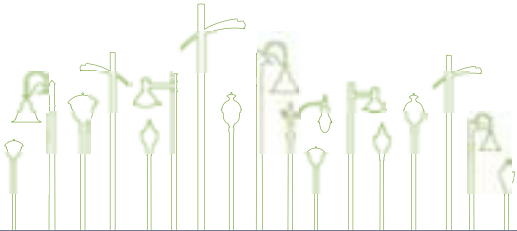
In two words : The Future. LifeLED™ is a LED light engine developed by Lumec. Its integrated components provide an efficient platform from which to produce light for outdoor roadway applications. The state-of-the-art elements of LifeLED™ work together to create a highly efficient light source.

- > Available on 7 luminaires series
LifeLED™, a multi-product technology offering you more than a million different designs.
- > Functional even in extreme environments of 122°F (50°C):
LifeLED™, optimal thermal efficiency.
- > 70 000 hours of operational lifespan
LifeLED™, a longer life.
- > 2 times greater pole spacing and 2 times more lumens in the target lighting zone
LifeLED™, an unparallel photometric efficiency compared to other LED optics.
- > Up to 50% energy savings
LifeLED™, a sustainable design.



LifeLED™ MULTI-PRODUCT TECHNOLOGY

Contrary to all the other outdoor LED products available on the market, LifeLED™ is a multi-product device. In other words, Lumec does not offer only one style of LED luminaires, but a whole variety of luminaires into which LifeLED™ can be inserted. Lumec is the only company that gives you the opportunity to choose from a multitude of colors, poles, and designs that will fit in with any project, allowing you to take full advantage of all the benefits that outdoor LED lighting brings to the table, without sacrificing the intended aesthetics of your project.



> Luminaires available with LifeLED™

S56 S56C1-FN10 S55 S55C2-FN10

Serenade DSX Series /
S55/S56

DM560-SHA DM550-SC-LM DM550-SHA-NM DM550-SC-MM

Domus Series /
DM550/DM560

AT10-SHA-PH-CPT AT20-SHA-CPT AT30-SHA-CPT AT40-SHA-CPT AT50-SHA-CAD-NM

Ancestra Series /
AT10/AT20/AT30/AT40/AT50

OT10-DC OT10-OT10-DC OT20-DC XL10

Optima Series /
OT10/OT20/XL10

TR10-SHA TR20-SCB-SN TR20-SCB-CAD-TN

Transit Series /
TR10/TR20

BR20 RN30-DC-SMA-MR RN30-SMA-CAD-MR RN30-DCI-SMA-CRMG

Renaissance Series /
RN20/RN30/BR20

LEN4/LEN5/LEN6

Leonis Series /
LEN4/LEN5/LEN6



LifeLED™ THERMAL EFFICIENCY

As with all LED products, heat is a major issue when it comes to performance. The state-of-the-art LEDs of LifeLED™ are mounted on a **specialized aluminum circuit board** and bonded to **an advanced aluminum heat sink** to keep the thermal junction of each LED as cool as possible. This allows the LifeLED™ engine to **function at peak performance** levels in extreme environments with temperatures that range from **-40°C/-40°F to +50°C/122°F**.

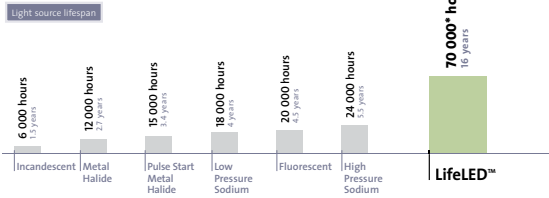
** For some regions, restrictions may apply. Please contact Lumec.*



LifeLED™ LONGEVITY

With approximately **70,000* hours of operational lifespan** (16 years at 12 hours per night), LifeLED™ far surpasses HPS typical 24,000 hour lifespan and MH's 10,000-16,000 hour lifespan. Since they lasts anywhere between 3 and 7 times longer, luminaires powered by the LifeLED™ need to be replaced less often than HID luminaires, contributing to significantly reduced maintenance costs.

** Calculated with an ambient temperature of 25°C / 77°F.*





LifeLED™ PHOTOMETRIC EFFICIENCY

The purpose of the LifeLED's™ optical system is to create a **desired photometric distribution**. The tiny luminous center of a LED and the fact that each LED can be controlled individually gives us **greater pole spacing and superior light quality on the ground compared** to other LED luminaires on the market. LifeLED™ produces photometric performance that rivals even the most advanced HID products.

Better photometric performance and pole spacing contributes to considerable financial savings. In order to achieve the same results, competitors using inferior LED light engines must use more luminaires spaced closer together to achieve comparable lighting levels and uniformity ratios. LifeLED™ has **superior photometric performance** allowing the use of fewer poles compared to other LED systems on the market.



LifeLED™ SUSTAINABLE DESIGN

Using LED outdoor lighting, for projects requiring even 175 watts MH* or 150 watts HPS*, is a highly visible way to spend ecologically minded public money. It is a direct way for citizens to see a city's efforts to **reduce energy consumption and improve global environmental conditions**, as well as for designers and project owners to show their commitment to this greater good.

Reduced maintenance costs and a **longer life** add value to any LifeLED™ powered luminaire. By alleviating the load on the public works department, a city not only saves money on luminaire repairs, parts replacement, and general maintenance, but also on the fuel consumption of the maintenance fleet, leading to lower greenhouse gas emissions and a reduced carbon footprint. Also, LifeLED™ meets the RoHS directive (which restricts the use of certain hazardous substances in electrical and electronic equipment).

* Please contact Lumec for more details.

REDUCED
MAINTENANCE COSTS

REDUCED
FLEET TRAVEL COSTS

REDUCED
MAN POWER HOURS

asimpleswitch.com



> LifeLED™ : Technical Information

The LifeLED™ was designed to be as versatile as possible and to give those that already have Lumec products options never before seen in the industry. LifeLED™ can be retrofitted into many existing luminaire designs. In other words, if you have compatible Lumec luminaires, you can take advantage of LifeLED™ without the need to purchase new fixtures.

For those that do not already have Lumec luminaires but are interested in the benefits of LED technology, Lumec offers a broad variety of ecologically responsible luminaires.

F

Flat lens
Ancestra / Optima /
Transit / Domus /
Renaissance



S

Sag lens
Ancestra / Optima /
Transit / Domus /
Renaissance



D

Drop lens
Domus



A

Prismatic
Globe
Ancestra / Optima /
Transit / Domus



R

Prismatic
Globe
Renaissance



> Luminaire efficacy rating (L.E.R.)

WATTAGE								
LAMP	SYSTEM							
40 W	45 W	56	63	63	64	68	59	N/A
60 W	66 W	54	61	61	62	65	57	N/A
82 W	95 W	47	53	53	54	57	49	N/A
		LE3F	LE3S	LE3D	LE3A	LE3R	LEONIS LE3	SERENADE DSX
		OPTICS						

- System wattage** includes the lamp and the LED driver.
- Luminaire efficacy** (lumens per Watt) is a specific measure of the net useful light output from the luminaire for a given power input.
- Light output of luminaire** is the total lumens output by a luminaire (as a whole).
- Measured power** is the total power consumed by a luminaire measured in Watts.

LifeLED™

MULTI-PRODUCT TECHNOLOGY

Technical and ordering information of
NEW LUMINAIRES



LifeLED™

MULTI-PRODUCT
TECHNOLOGY

> LED luminaires available

Ancestra Series /
AT10/AT20/AT30/AT40/AT50



Optima Series /
OT10/OT20/XL10



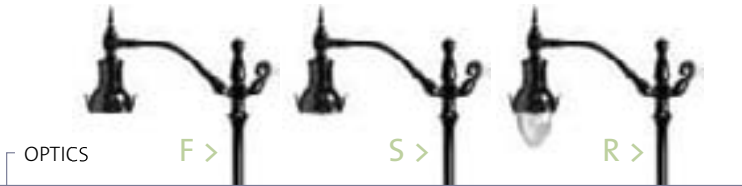
Transit Series /
TR10/TR20



Domus Series /
DMS50/DMS60



Renaissance Series /
RN20/RN30



Serenade DSX Series /
S55/S56



Leonis Series /
LEN4/LEN5/LEN6



> Ordering example

To order a new luminaire with LifeLED™, take note of the appropriate lamp, globe / lens finish and optical system needed and then, consult the existing brochure of the luminaire to have access to the options available.

AT10	82LED63L6K	—	LE2F	CPTC	CRA-1A	R80A-12	GN6TX
Luminaire	Lamp	Globe/lens finish	Optical system	Options*	Mounting and configuration*	Pole*	Finish*

> LED lamp details *(for the latest updates on LED lamp details see our web site www.lumec.com)*

82 LED	63L	6K										
Color Temperature	Initial Approximate Lumens	Light-Emitting Diode	Lamp	Rated Avg. Life Hrs. ¹	Initial Approximate Lumens	Mean ²	CRI	Color Temperature ³	Lamp Wattage	System Wattage		
			40LED35L6K	70000	3500	2975	72	6000K	40	45		
			60LED50L6K	70000	5000	4250	72	6000K	60	66		
			82LED63L6K	70000	6300	5355	72	6000K	82	95		

¹ Rated average life represents the time it takes for the LED system to reach 70% of initial lumen output.

² The measured luminous output of a new light source versus the output at 50% of lamp life.

³ On average.

> Optical System : Distribution type available per optic

DISTRIBUTION	II	III	IV	V	LE2F	LE2S	LE2D	LE2A	LE2R*
					LE3F	LE3S	LE3D	LE3A	LE3R*
					LE4F	LE4S	LE4D	LE4A	LE4R*
					LE5F	LE5S	LE5D	N/A	N/A
					F	S	D	A	R

OPTICS

available with the following globes finishes :

* ACDR : acrylic
GL : borosilicate

> Voltages *(auto-adjusting)*

120 / 208 / 240 / 347*

* Comes with a step-down transformer





LifeLED™ RETROFIT KIT

Technical and ordering information of
RETROFITTING EXISTING LUMINAIRES



LifeLED™

RETROFIT KIT

It is also possible to retrofit current Lumec luminaires. Keep the current infrastructure and simply replace the light source by the LifeLED™. With other LEDs, it is impossible to keep an existing infrastructure because their light does not stretch as far as the existing HID lighting already in place. LifeLED™ is the only light engine that uses LEDs (lowering energy consumption up to 50%) and permits to keep existing infrastructure because it spreads out the light twice as far while delivering equal if not better photometric performance. The race towards the first truly green city is on. Lumec can help any city achieve that goal.

To find a way to retrofit other luminaires, please contact Lumec.

> Lumec luminaires / LifeLED™ retrofit

Ancestra Series /
AT10/AT20/AT30/AT40/AT50



Optima Series /
OT10/OT20/XL10



Transit Series /
TR10/TR20



Domus Series /
DMS50/DMS60



Renaissance Series /
RN20/RN30



> Ordering example

To order LifeLED™ for an existing Lumec luminaire, take note of the appropriate lamp, globe / lens finish and optical system needed.

AT10	82LED63L6K	—	LE2F
Luminaire	Lamp	Globe/lens finish	Optical system

> LED lamp details (for the latest updates on LED lamp details see our web site www.lumec.com)

82 LED 63L 6K	40LED35L6K	70000	3500	2975	72	6000K	40	45
	60LED50L6K	70000	5000	4250	72	6000K	60	66
	82LED63L6K	70000	6300	5355	72	6000K	82	95
	Lamp	Rated Avg. Life Hrs. ¹	Initial Approximate Lumens	Mean ²	CRI	Color Temperature ³	Lamp Wattage	System

¹ Rated average life represents the time it takes for the LED system to reach 70% of initial lumen output.
² The measured luminous output of a new light source versus the output at 50% of lamp life.
³ On average.

> Optical System : Distribution type available per optic

DISTRIBUTION	II	LE2F	LE2S	LE2D	LE2A	LE2R*
	III	LE3F	LE3S	LE3D	LE3A	LE3R*
	IV	LE4F	LE4S	LE4D	LE4A	LE4R*
	V	LE5F	LE5S	LE5D	N/A	N/A
		F	S	D	A	R

OPTICS

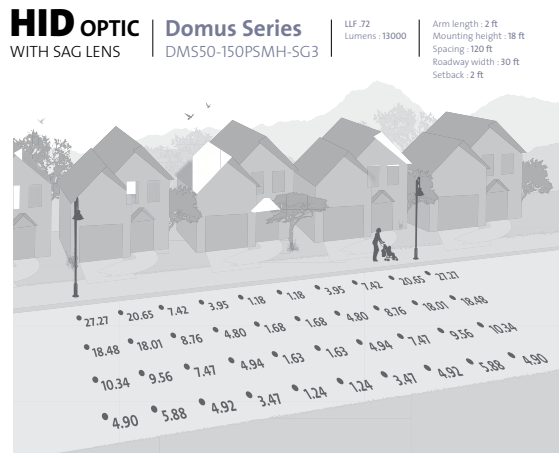
available with the following globes finishes :
* ACDR : acrylic
GL : borosilicate

> Voltages (auto-adjusting)

120 / 208 / 240 / 347*

* Comes with a step-down transformer





Lux	8.33	27.27	1.18	7.06	23.11
Fc	0.77	2.53	0.11	7.00	23.00
	Average	Maximum	Minimum	Avg/min	Max/min

WATTAGE

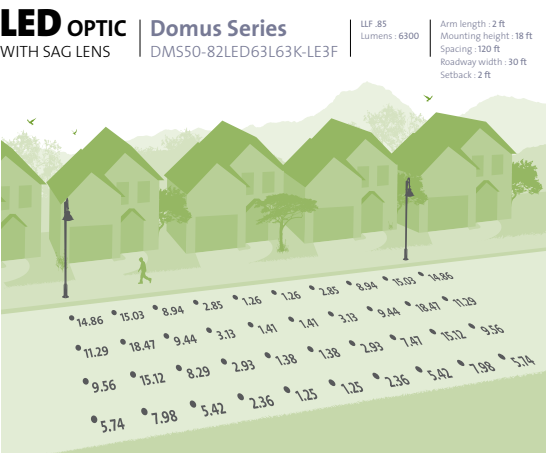
LAMP

SYSTEM

150 W

190 W

* This is one scenario. Please download IES files from our Web site www.lumec.com to see what the LifeLED™ can do for your project.



Lux	7.33	18.47	1.25	5.86	14.78
Fc	0.68	1.72	0.12	5.67	14.33
	Average	Maximum	Minimum	Avg/min	Max/min

WATTAGE

LAMP

SYSTEM

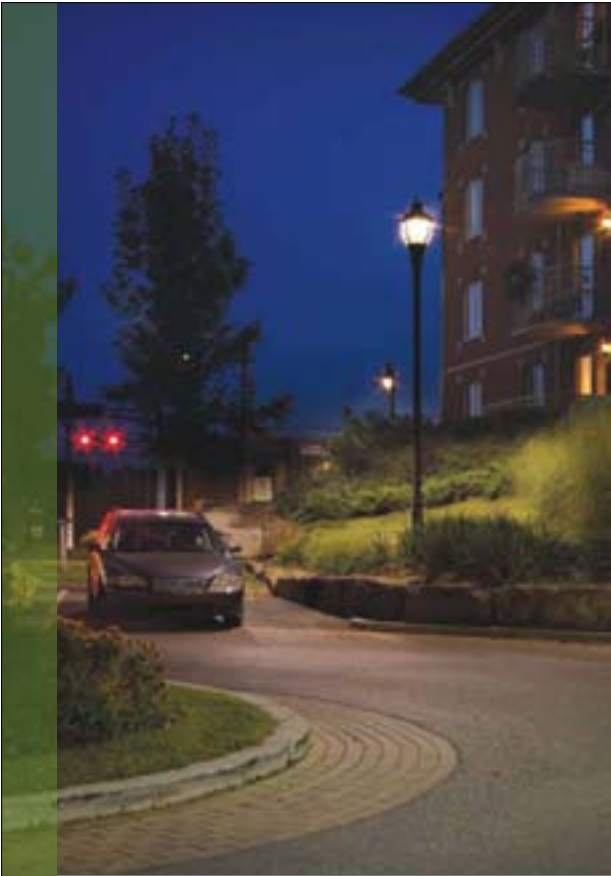
82 W

95 W

ENERGY SAVINGS OF

50%

* This is one scenario. Please download IES files from our Web site www.lumec.com to see what the LifeLED™ can do for your project.



P24 > LifeLED™

Fear of the dark...

At Lumec, we recognize that decision makers still have a justifiable concern when it comes to LED lighting. With all these new companies developing LED luminaires who can you trust? Who will still be there in 20 years when the fixtures need replacing? Which company will be able to provide service for new technology when needed and to offer a platform enabling technology improvements?

Research is necessary to any new technology. The industry will necessarily shift to solid-state lighting, it is but a question of time; who to trust, who to go with, who to use, that requires a little bit of research. Companies such as Lumec that have a long business record, companies that are trusted by the major associations in the field (ASLA, IES, IDA, et cetera), companies that will still be there in 20 years because they have been around for a long time and are known for their contribution to the cause, are a sure bet. Trust experience when making your decision in this field and do a little bit of research, you will find that the answers are not that hard to find.

P25 > LifeLED™

At Lumec we believe that the lighting industry will play a considerable part in the reduction of worldwide energy consumption. The industry is shifting rapidly towards environmental responsibility. Lumec contributes to the cause in the form of major research into reducing material inputs, reducing maintenance costs, reducing energy consumption, reducing light pollution, increasing light efficiency, increasing design life and increasing recyclability of all our products. LifeLED™ is one example of our commitment. In addition to providing an overall reduction in energy consumption, LifeLED™ reaches the highest performance requirements in terms of intensity and uniformity.

> Available on 7 luminaires series

LifeLED™, a multi-product technology offering you more than a million different designs.

> Functional even in extreme environments of 122°F (50°C):

LifeLED™, optimal thermal efficiency.

> 70 000 hours of operational lifespan

LifeLED™, a longer life.

> 2 times greater pole spacing and 2 times more lumens in the target lighting zone

LifeLED™, an unparallel photometric efficiency compared to other LED optics.

> Up to 50% energy savings

LifeLED™, a sustainable design.



LUMEC

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Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contains Mercury" and/or with the symbol "Hg." Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org

15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	01:00	02:00
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