



**OLD CAPITOL GREEN LANDSCAPE MANAGEMENT PLAN**  
MISSISSIPPI DEPARTMENT OF ARCHIVES AND HISTORY

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Prepared by Native Habitats, Inc.

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# **1 Introduction**

This Landscape Management Plan (LMP) has been developed in order to guide efforts by the Mississippi Department of Archives and History to successfully manage the grounds surrounding the Old Capitol Museum, the War Memorial, and the Charlotte Capers Building. The document seeks to give general information that might be useful to the layperson, while also giving direction and describing specific tasks to those who will perform the work.

## **1.1 LMP Format**

This LMP is set up with the understanding that conditions at the Old Capitol Green will change over time as this plan is implemented, and therefore the document will need to be updated periodically to address new issues in the landscape.

This introductory chapter contains general information on the way that data was collected to develop the LMP, what laws and regulations might apply to its implementation, and a map of the site. Chapter 2 provides a broad overview of the landscape of the site, and Chapter 3 describes the proposed management approach. Chapter 4: Landscape Management Schedule lays out a month by month schedule of basic tasks to be performed in the landscape. A thorough description of what is required for the proper implementation of each task is contained in Chapter 5: Landscape Management Procedures. Irrigation system operation and maintenance is covered in Chapter 6. Chapter 7 consists of a thorough glossary of terms used in the LMP. In Chapter 8, a list of references and recommended further reading is provided.

In addition to the main text chapter, there are three appendices. These contain not only the most specific information in the LMP, but also the information that will need to be updated regularly. Appendix A covers fertilization and is based on soil tests taken in June of 2017. Appendix B consists of an inventory of trees and recommended management actions for each. The report concludes with Appendix C: Task Prioritization, which should be used to determine which issues should be addressed and in what approximate order they should be addressed.

## **1.2 Methodology**

We began the development of this LMP with a thorough inventory and analysis of all landscape features, including trees, shrubs, grass, irrigation, etc. After drawing a site map (Figure 1-1: Old Capitol Green Site Map), we divided the site into logical areas based on type of vegetation and the presence of natural or man-made barriers. We then took soil tests in each area and sent them to the MSU Soil Testing Laboratory for analysis and recommendations.

## **1.3 Applicable Laws and Regulations**

Mississippi law regulates the professional services required to perform some of the tasks that will be necessary to properly manage the landscape of the Old Capitol Green. Mississippi Code, Sections 69-19-1 through 69-19-11 states that "Persons receiving fees for performing work related to entomology, plant pathology, horticulture, tree surgery, weed control, pest-management consultant services and professional soil classification are required to be licensed to protect the citizens of this state from fraudulent practices." State licenses that may be applicable include, but are not limited to the following:

- **Horticultural pest control (HCPL)** - This category includes persons engaged in control of insect pests, plant diseases, or pest animals of ornamental plants, shade trees (which may include nut or fruit trees if used as ornamental plants or shade trees) and lawns in residential, commercial, public, industrial and manufacturing areas.
- **Horticultural weed control (HCWL)** -This category includes control of weeds in ornamental plants and turf in residential, commercial, public, industrial and manufacturing areas.
- **Landscape Horticulturist (LSL)** – This category shall include a person receiving fees for landscaping and setting of plants or for the sale of any plants for which the seller contracts to render future services
- **Tree Surgery (TS)** - This category includes a person who advertises in a local phone book, newspaper, newsletter, bulletin, the internet or other prominently displayed sign as a licensed or insured tree surgeon and receives compensation for any work or consultation relative to the care, pruning, cabling, bracing, topping, trimming, fertilizing, cavity work and removal of ornamental trees and shrubs in any manner. Nothing shall prevent any person from performing such services as long as their advertising does not include the description licensed or insured.

## 1.4 Site Map

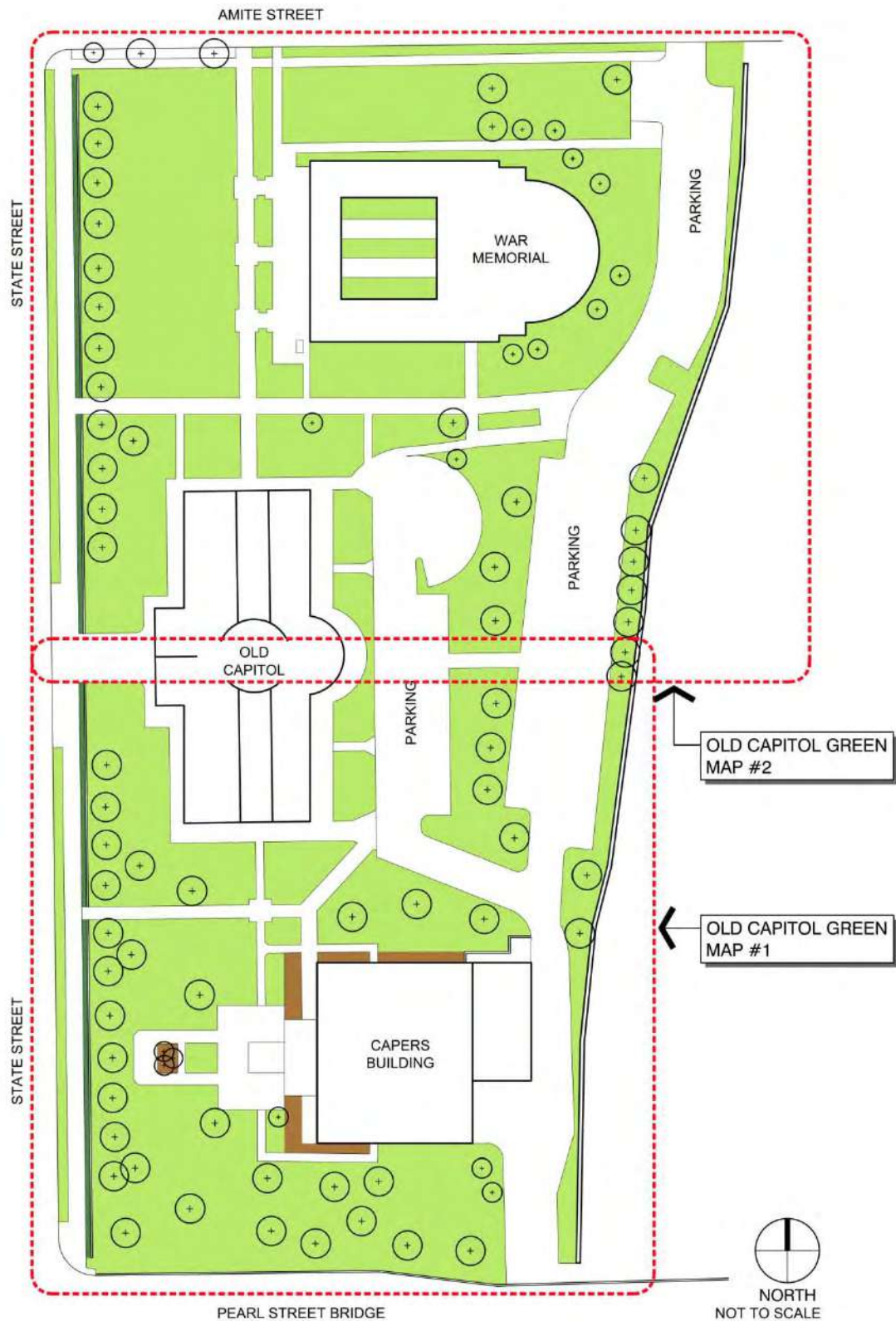


Figure 1-1: Old Capitol Green Site Map

## **2 Landscape Overview**

According to the 2009 report on the restoration of the Mississippi Old Capitol Building by Robert Parker Adams, the current configuration of the landscape consisting of large oaks and open expanses of lawn is based on the original landscape of "virgin oaks left from the original forest..." when the Old Capitol was constructed. The new linear planting of white oaks inside the fence line along State Street was intended to replace the old, large, but also declining-in-health oaks nearer to the curb. These older trees remained in place for several years after the planting of the white oaks, but have since been removed. Oaks along the western edge of the site, though not historically precededented, were planted to "limit the view of recent development and to suggest the swamp area to the east."

### **2.1 Lawn**

The majority of the ground-plane is planted with turf grass. As is often the case with sites with a long, layered history of site changes, there are multiple species of turf grass on site. Though this offers some challenges for management, minor adjustments to current practices can result in healthier and more attractive lawn areas.

### **2.2 Groundcovers**

With the exception of lawn, there are only two kinds of groundcover on-site. There is a very small area containing Liriope on the south side of the Capers Building. The most abundant and most visually prominent groundcover consists of the Asiatic Jasmine growing between the reconstructed fence with limestone foundation wall and the sidewalk along State Street.

### **2.3 Shrubs**

The existence of shrubbery at the Old Capitol Grounds is minimal and merely consists of a few isolated individuals on the south side of the War Memorial, foundation shrubs at the Capers Building, and screening shrubs along the boundary with the Pearl Street Bridge.

### **2.4 Trees**

The trees of the Old Capitol Green give some of the first impressions to visitors and add value to the everyday lives of Jackson's residents. Trees add beauty to the property through the softening and complementing of the architectural design and through creating a pleasant environment. The trees improve the quality of life now and will continue to do so in the future, provided they are managed to reach their full potential.

Though the trees at the Old Capitol add great value to the property, these same trees can also be a liability or hazard if not properly taken care of. Trees that are not properly managed can fail in storms, damaging property and posing a high degree of risk to people. The lack of proper management can also result in trees that are more susceptible to environmental stresses. Building a well-planned management program will help care for these assets and identify existing and potential liabilities. Failing to manage trees is an option that always costs more in the long run. By investing wisely in your trees, values can increase for both present and future generations.



### **3 Landscape Management Approach: Integrated Pest Management**

#### **3.1 General**

Integrated Pest Management (IPM) is a landscape management approach that focuses on keeping pests numbers low enough to minimize the plant damage in landscapes, rather than on completely eliminating all pests. We recommend an IPM approach to the landscape of the Old Capitol Green's landscape, and our recommendations contained in this management plan are based on such. The basics of IPM are summed up in the following:

##### **3.1.1 IPM Steps Include:**

- Prevention first: Plan cultural practices to minimize pests (watering, mulching, pruning, etc.).
- Identify/know the pest (weed, etc.) life cycle.
- Set action thresholds – tolerate some damage.
- Monitor regularly (keep records of monitoring).
- When pests exceed threshold, use control method with the least impact on non-target species. Try cultural, physical, or biological methods first. As a last resort, use spot applications of the least toxic chemical. Only treat when the pest is most vulnerable and its natural enemies are in their least susceptible life stage.
- Keep records of control methods and results, evaluate, and adapt cultural practices as needed.

##### **3.1.2 General Weed Control Guidelines**

- Crowd out weeds with dense, healthy plantings, ground covers and shade canopies.
- Accept a few weeds; target the problem ones.
- Mulch beds in fall, winter, or early spring.
- Control weeds before they go to seed.
- Don't over-fertilize; it promotes weeds and pests. Further, fertilize according to regular soil tests. We recommend a maximum of three years in between soil tests.
- Spot apply the least-toxic chemical in order to minimize damage to non-weeds.
- If a pesticide must be used, it must be applied by a licensed applicator and according to the product label.

##### **3.1.3 Weed Control for Trees, Shrubs, and Groundcovers**

- Weeds in planted areas, sidewalks, curbs, gutters, or pavement shall be removed or killed weekly as the weeds emerge. Weeds shall be removed if they are larger than 2 inches (5 cm) in height or diameter. Compost weeds, if feasible. Otherwise, dispose of weeds off-site. Regular maintenance of the mulch layer will help minimize weeds in shrub and groundcover areas.
- Except where otherwise indicated, weed-control techniques should be limited to mulching and hand-pulling. If herbicides must be used, choose the least toxic available and spot apply on weeds.

### 3.1.4 **Weed, Insect and Disease Control for Lawn**

- Weed invasion can be effectively prevented or reversed by growing dense lawn using the practices recommended in section 5.1.1, below. Tolerate some broad-leaved plants in lawn areas. Identify problem (invasive) weeds and target only those species.
- Properly adapted turf grass coupled with proper irrigation, fertilization, aeration, and mowing practices rarely develop serious disease problems. Correcting poor soil conditions or cultural practices (like over-watering or over or under-fertilization) will make the turf capable of withstanding much pest pressure and recovering from damage that occurs without much pesticide use. See 5.1.
- Several insects and diseases are mentioned in section 5.1.1, below. IPM techniques of monitoring, setting tolerance levels, and applying the least-toxic control can be effective.

## 4 **Landscape Management Schedule**

### 4.1 **Monthly Tasks**

This guide to monthly landscape management tasks is based on the typical year. Since weather patterns vary from year to year, some adjustment to the timing of each of the following tasks may be necessary.

#### **January**

- Monitor lawn for winter weeds. Identify and document weed species present.
- Continue to remove excessive tree leaves from lawn by raking, blowing, vacuuming, or mowing with a bagging mower.
- Prune any broken or dead branches on shrubs and trees. Do not perform other significant pruning this month.

#### **February**

- Monitor for winter weeds. Identify and document weed species present.
- Shear Liriope late this month to a height of approximately 3 to 4 inches every other year.
- Make thinning cuts on Dwarf Yaupon Holly, Rotunda Holly, and Sweet Olive to allow airflow and adequate light penetration to the interior of the plants. Do not shear until next month.
- Monitor and hand-weed shrub beds as needed.
- Perform structural pruning on young trees.

#### **March**

- Monitor lawn for winter weeds; mow as needed while flowering to prevent weeds from setting seed.
- Apply pre-emergent for summer weeds.
- Fertilize groundcovers according to Appendix A.
- Shear Liriope early this month if not done in February to a height of approximately 3 to 4 inches every other year.
- Shear Asiatic Jasmine to a height of approximately 8 to 10 inches.
- Fertilize shrub areas according to Appendix A.
- Prune Dwarf Yaupon Holly, Rotunda Holly, and Sweet Olive.

## April

- Fertilize lawn areas according to Appendix A.
- Monitor turf for brown patch and dollar spot and document the presence of either.
- Monitor Hybrid Bermuda for spring dead spot and document.
- Begin mowing at regular recommended height as lawn begins to turn green. See Table 5-1.
- Monitor Red Tip Photinia for entomosporium leaf spot. Remove any infected leaves and twigs and dispose of in a legal manner. Disinfect pruners between cuts to prevent spread of leaf spot.
- Monitor and hand-weed shrub beds as needed.

## May

- Aerate lawn areas with a core-aerator to a depth of at least 3-inches. See Aeration, Lawn Cultural Practices in section 5.1.1.
- Fertilize lawn areas according to Appendix A.
- Monitor St. Augustine for chinch bugs and document.
- Watch for brown patch, and document. Where brown patch is present, bag clippings and dispose of in a legal manner.
- Watch for gray spot on St. Augustine, and document. Where gray spot is present, bag clippings and dispose of in a legal manner.
- Make second application of pre-emergent to control summer weeds. This second application must be made after any lawn aeration.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing.
- Fertilize shrub areas according to Appendix A.
- Monitor and hand-weed shrub beds as needed.

## June

- Fertilize lawn areas according to Appendix A.
- Watch for gray spot on St. Augustine, and document. Where gray spot is present, bag clippings and dispose of in a legal manner.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing.
- Monitor and hand-weed shrub beds as needed.
- Prune Dwarf Yaupon Holly, Rotunda Holly, and Sweet Olive by shearing. Thin outer canopy as needed.

## July

- Irrigate lawn areas as needed.
- Watch for gray spot on St. Augustine, and document. Where gray spot is present, bag clippings and dispose of in a legal manner.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing. If previously mowing at the low end of the recommended height range, consider raising mowing height to the upper end of the recommended range this month to minimize heat and drought stress. See Table 5-1.
- Fertilize shrub areas according to Appendix A.
- Monitor and hand-weed shrub beds as needed.

## **August**

- Fertilize lawn areas according to Appendix A.
- Irrigate lawn areas as needed.
- Watch for gray spot on St. Augustine, and document. Where gray spot is present, bag clippings and dispose of in a legal manner.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing. Mow at the high end of the recommended height range for each turf type. See Table 5-1.
- Fertilize shrub areas according to Appendix A.
- Monitor and hand-weed shrub beds as needed.
- Prune Dwarf Yaupon Holly, Rotunda Holly, and Sweet Olive by shearing. Thin outer canopy as needed.

## **September**

- Irrigate lawn areas as needed.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing. Mow at the high end of the recommended height range for each turf type. See Table 5-1.
- Monitor St. Augustine for chinch bugs, and document.
- Monitor for dollar spot or brown patch, and document. Where either is present, bag clippings and dispose of in a legal manner.
- Monitor and hand-weed shrub beds as needed.
- Limit pruning to the removal of dead, diseased, or broken wood.

## **October**

- Irrigate lawn areas as needed.
- Continue to mow at the recommended heights, never cutting more than 1/3 of the leaf blade in any one mowing. Mow at the high end of the recommended height range for each turf type. See Table 5-1.
- Monitor St. Augustine for chinch bugs, and document.
- Monitor for dollar spot or brown patch, and document. Where either is present, bag clippings and dispose of in a legal manner.
- Monitor and hand-weed shrub beds as needed.
- Limit pruning to the removal of dead, diseased, or broken wood.

## **November**

- Irrigate lawn areas as needed.
- Mow lawn periodically at the recommended heights to shred fallen tree leaves.
- Monitor for dollar spot or brown patch, and document. Where either are present, bag clippings and dispose of in a legal manner.
- Limit pruning to the removal of dead, diseased, or broken wood.

## **December**

- Remove excessive tree leaves from lawn by raking, blowing, vacuuming, or mowing with a bagging mower.
- Limit pruning to the removal of dead, diseased, or broken wood.

## 5 Landscape Management Procedures

### 5.1 Lawn

Our assessment found at least three types of turf grass growing on the Old Capitol Green, each which requires a slightly different management regime, particularly in regards to mowing height and fertilization. Recommended mowing height for each turf grass type can be found in below. Fertilization recommendations based on soil tests and type of grass can be found in Appendix A. We also found numerous weed species growing amongst the turf, but only a few of these represents more than a minor threat to the health or aesthetic value of the lawn.

This chapter will begin with a description of the cultural practices that should be employed in managing the lawn, with a section on weed control following.

#### 5.1.1 Lawn Cultural Practices

Employing proper cultural practices in the management of a lawn can minimize the incidence of pests, diseases, and other undesirable characteristics, and therefore reduce the financial burden of maintaining a lawn while maintaining or improving its appearance. These cultural practices include mowing, fertilization, aeration, and watering. Each will be considered below:

##### **Mowing:**

- Mow at the recommended height for the species and variety of grass grown. See Table 5-1.
- Do not cut more than 1/3 of the total leaf blade in any one mowing.
- Mow only with sharp blades. Zoysia grass will quickly dull mower blades. Sharpen frequently.
- Do not bag clippings. Use a mulching deck mower.
- Change the mowing direction at each mowing to avoid soil compaction and reduce rutting. Develop a minimum of 2-3 mowing patterns for the site and cycle through before repeating.
- Do not mow when the grass is wet or moist.

##### **Edging**

The edging of lawn areas prevents turf grass from migrating onto sidewalks and into planting beds. Edging should be conducted with a mechanical device specifically designed for edging.

- Edge lawn bordering paved areas at each mowing.
- Edge lawn bordering planted areas a minimum of 3 times per growing season.
- Take particular care when edging around tree mulch rings; do not disturb or damage tree roots.

##### **Fertilization**

- Fertilize according to Appendix A.
- Soil samples should be taken at a minimum of once every three years and the Fertilizer Schedule adjusted accordingly.

- The nitrogen component of the fertilizer should be in at least a 50% slow-release form. See Fertilization.
- Apply lime to balance pH as recommended by soil samples. See Appendix, Item A.2.2.

## Irrigation

- Lawns should receive the equivalent of 1-inch of water each week during the active growing season, either through natural rainfall or through supplemental irrigation.
- Do not over-water.
- One inch of water applied once per week is generally better than smaller amounts applied more frequently. However, the clay soils at the Old Capitol Green will produce runoff if water is applied too quickly. To avoid this, the irrigation system should be set based on a cycle and soak concept. For example, rather than running each zone for 60 minutes, run each zone for 20 minutes and then cycle through 3 times. This allows the water to infiltrate the soil more deeply.
- If regular watering is not feasible due to financial constraints, consider watering only when the turf is under significant drought stress.

## Aeration

- Aerate one-third of the total lawn area once every three years to reduce surface soil compaction.
- Rotate aeration applications to achieve 100% lawn area aeration every three years at minimum.
- Aerate in spring after grass has fully greened-up.
- Use a core aerator only; do not use a spike or tine aerator.
- Should the implementation of aeration to the entirety of the Old Capitol Green's lawns be financially unfeasible, consider limiting aeration to the most heavily trafficked (and therefore most compacted) areas of lawn. The highest priority should be the area just to the east of the Old Capitol, in between the building and the upper parking lot.

Table 5-1: Recommended Turf Mowing Heights

Type of Grass	Mowing Height (inches)
St. Augustine	3 - 4
Hybrid Bermuda	0.75 -1.5
Zoysia	2 - 3

### 5.1.2 Weed Control

#### 5.1.2.1 Pre-Emergent Herbicides

Crabgrass (*Digitaria* sp.) and Dallis grass (*Paspalum dilatatum*) represent the biggest threats to the lawn areas. Crabgrass, besides negatively affecting the growth of turf grass through competing for light, water, and nutrients, also has allelopathic qualities. Dallis grass grows at a

much higher rate than any of the three types of turf grasses on site, inhibiting the growth of turf grass through competition. In addition, its large, coarse textured-leaves are extremely noticeable and consequently lend an obvious appearance of weediness to the lawns.

As an annual, crabgrass can be easily controlled with a pre-emergent herbicide applied according to the manufacturer's label in the late winter or early spring.

Dallis grass, though a perennial and therefore somewhat harder to control, can be reduced significantly with the use of a pre-emergent herbicide each year. Pre-emergent herbicides targeting crabgrass typically will also target Dallis grass.

#### 5.1.2.2 **Post-Emergent Herbicides**

We do not recommend the use of post-emergent herbicides on lawn areas at the Old Capitol Green. The implementation of proper cultural practices and properly timed applications of pre-emergent herbicide will provide an appropriate level of weed control after several growing seasons.

## 5.2 **Groundcovers**

There are two groundcovers currently growing on the site. Two small masses of Liriope (*Liriope muscari*) line the edge of the shrub beds on the eastern end of both the north and south sides of the Capers Building. The most visually prominent groundcover on site is the Asiatic Jasmine (*Trachelospermum asiaticum*) planted between the fence line and the sidewalk along State Street.

### 5.2.1 **Liriope**

The Liriope is in good condition and will require very little maintenance. Other than occasional hand-weeding and the fertilization outlined in Appendix A, the Liriope would benefit from being sheared back to three or four inches high in late winter prior to beginning new growth approximately every other year. Do not cut after new growth has begun. Do not scalp plants. Be sure that cuts are several inches above the basal crown.

### 5.2.2 **Asiatic Jasmine**

The Asiatic Jasmine (Figure 5-1) is performing well in approximately 60% of its intended growing area. It was reported to us that in the areas in which it is struggling, it has been replanted at least twice since 2009. Our assessment of these areas detected no discernible difference in soil composition or fertility. After monitoring multiple times over a period of two months, our conclusion is that the Asiatic Jasmine's inability to become effectively established is entirely due to incorrect cultural practices.

The areas containing the struggling Asiatic Jasmine also contain a proliferation of weeds such as crabgrass and nutsedge. It appears that the current method being used to control these weeds is by shearing the entire area with a string trimmer to a height of approximately 1-2 inches. This process is causing major damage to the young Asiatic Jasmine plants (Figure 5-2) that are intended to cover the ground and which, once established, will out-compete most of the weeds. The Asiatic Jasmine in these struggling areas should NOT be cut with a string trimmer, except for edging along the sidewalk, until the Jasmine has fully colonized the areas. Weeds should be controlled with a selective herbicide(s) that targets the weed species present, but will not harm the Jasmine. The application of a pre-emergent would aid considerably in the control of the crabgrass. The nutgrass will need to be targeted with a post-emergent herbicide. In addition, apply and maintain a two to three-inch layer of pine straw mulch in this area to facilitate

the spread of the jasmine while helping to suppress the weeds. After the jasmine is fully established, maintain by shearing at a height of approximately 10 to 12-inches.

In addition to the above recommendations, the Asiatic Jasmine should be fertilized according to Appendix A.



Figure 5-1: Asiatic Jasmine. Healthy in foreground, struggling in background.



Figure 5-2: Scalped Asiatic Jasmine surrounded by weeds



Figure 5-3: Asiatic Jasmine that has been inhibited from spreading by weed-eating

### 5.3 Shrubs

The Old Capitol Green is largely devoid of shrubbery. Except for two isolated clumps of two individual Sweet Olive (*Osmanthus fragrans*), each just west of the southern entry door to the War Memorial Building, and an isolated mass of Dwarf Yaupon Holly east of the lower parking lot, the only shrubs on site are in the immediate vicinity of the Capers Building. The shrubs at the Capers building consist of Dwarf Yaupon Holly (*Ilex vomitoria* 'Nana') growing at the front (west) entrance to the building and extending partially along the north and south walls, and Rotunda Holly (*Ilex chinensis* 'Rotunda') running the rest of the length of the north and south walls, and several large Red Tip Photinia (*Photinia glabra*) growing along the border with the Pearl Street bridge.

Management of shrubs and shrub beds should consist of mulching, fertilization, watering, weeding, and pruning.



### 5.3.1 Mulching Shrubs and Shrub Beds

Mulch should be utilized for its ability to suppress weeds, retain moisture, and provide organic matter that enhances the biological activity in the soil. All shrub beds, isolated large shrubs, and young trees should be mulched with a 2-3 inch layer of pine straw, hardwood mulch, or pine bark mulch. The maintenance of a 2-3 inch layer does not mean that a 2-3 inch layer should be applied at any one time (unless none exists), but that the total layer should be maintained at that height. For instance, if one inch at the soil/mulch line decomposes during the course of one year, add one inch of mulch to return the mulch layer to its optimal depth. Refresh mulch approximately once per year, or as needed. Do not mulch against the trunks of shrubs or trees.

### 5.3.2 General Shrub Pruning Techniques

All pruning shall be conducted in accordance with the standards outlined in *ANSI A300: Standard Practices for Tree, Shrub and other Woody Plant Maintenance* (latest edition) and *ANSI Z133.1 The American National Standards Institute Standard for Safe Working Practices In and Near Trees* (latest edition).

Pruning of shrubs is much simpler than that of trees. Shrubs are primarily pruned to manage their size, and much less so for structural reasons. Shrub pruning, however, must be done properly in order to maintain the health of the plant. General rules are as follows:

- Always remove all dead, diseased, or injured branches.
- Shearing (when used) should be combined with selective reduction and thinning cuts to manage the shrub size and minimize the development of a foliage curtain.
- Reduction and thinning cuts should be utilized rather than shearing where a less formal, more "natural" aesthetic is desired.
- Shrubs should always be pruned so that the base of the shrub is wider than the top. The one exception to this would be "tree form" shrubs where lower limbs have been removed—this foliage containing portion should always larger at the base than at the top.

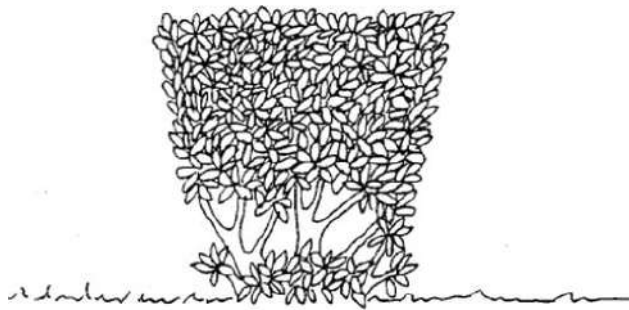


Figure 5-4: Improperly sheared hedge with base narrower than top.

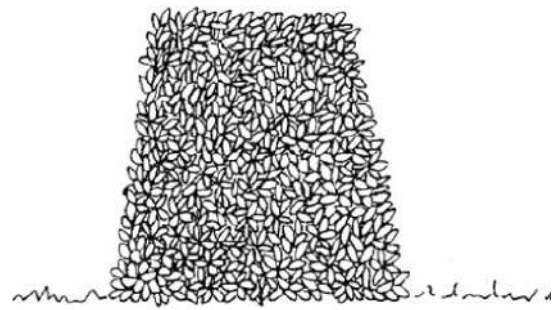


Figure 5-5: Properly sheared hedge with base wider than top. Shrub can be sheared to a more rounded shape than depicted, but base should always be wider than the top.

### 5.3.3 Sweet Olive

Sweet Olive naturally grows much larger than the space that they are presently in can accommodate. Therefore, they will need to be maintained at their present size with frequent pruning. Currently they are being sheared regularly. This practice can continue, but selective thinning should be added to their management at least once per year in order to ensure that healthy new growth is constantly being created from the interior portion of the shrub. In

addition, they should be sheared such that the bottom of the shrub is wider the top; this will ensure that sunlight adequately reaches all foliage.



Figure 5-6: Sweet Olive Shrubs

#### 5.3.4 Dwarf Yaupon Holly

Dwarf Yaupon Holly is frequently grown as a hedge in Mississippi due to its tolerance to difficult conditions and its ease of maintenance. The hedge masses of Yaupons throughout the site are in relatively good condition. However, there are some problems with these hedges. There is considerable thinning along the lower edges of the hedges due to the shrubs being pruned in such a manner that the base is narrower than the top (See Figure 5-4 and Figure 5-5), there is dead wood that should be removed, and there is very little consistency among the shapes and sizes of the shrubs at the Capers building.

We have several recommendations for the management of the Yaupon hedges. They are as follows:

- Begin pruning so that the base of the shrubs is wider than the top as depicted in Figure 5-5.
- Remove any dead branches.
- Gradually (over 2-3 growing seasons), reduce the height of the hedge against the wall on the north side of the Capers Building to approximately 3-4 feet high. Do not allow branches or foliage to rest against the building wall. Prune back from the wall about 6 inches to 1 foot. This is best for the shrubs and the building.
- Develop a consistent shape and size across shrubs close in proximity.
- In addition to shearing, practice selective thinning at least once per growing season to allow light penetration into the interior portion of the shrubs. This will aid in height reduction efforts.



Figure 5-7: Dwarf Yaupon Holly at northwest corner of Capers Building



Figure 5-8: Dwarf Yaupon Holly at southwest corner of Capers Building

### 5.3.5 Rotunda Holly

The beds in which Rotunda Hollies are growing contain considerable numbers of tree saplings and vines. Remove these – a cut stump herbicide application may be necessary for control of the tree saplings. Maintain the height of the Rotunda Hollies in the 3-4 foot range. Provide approximately 6 inches to 1 foot of clearance at building wall. Maintain hedge by shearing and selective thinning.



Figure 5-9: Dwarf Rotunda Holly along south side of Capers Building



Figure 5-10: Dwarf Rotunda Holly along north side of Capers Building

### 5.3.6 Red Tip Photinia

Approximately ten Red Tip Photinias are growing at the southern edge of the site along the Pearl Street Bridge. Little to no pruning is required of these shrubs, as their large size contributes to their effectiveness as a visual screen and sound barrier. Limit pruning to removal of dead, dying, or diseased branches.

There is considerable weed pressure around the Red Tip Photinias, however, including tree saplings, invasive shrubs, and vines. The woody weeds in particular are obscuring the visibility of traffic signs along the westbound lanes of Pearl Street. The sign directing drivers to the Old Capitol Museum is completely blocked. Remove these weeds and apply mulch at each shrub to the approximate of the extent of the canopy.

## 5.4 Trees

Our inventory and assessment of the Old Capitol Green revealed a total of 81 trees on the site (82 are indicated on the inventory, but one tree has been removed). The trees were assessed according to their condition and ranked as good, fair, poor, or hazardous. Most (56.8%) of the trees were ranked as in good condition, followed by 19.8% in fair condition, 13.6% in poor condition, and 9.9% (8 trees) in hazardous condition. All trees ranked as hazardous are in such condition due to girdling of the trunk by the initial planting guy-wire remaining on the tree far too long. See Appendix B.

The trees ranked as hazardous represent a risk to people and property, and should be removed as soon as possible.

The trees in good, fair, and poor conditions should be pruned, mulched, and receive root treatments according to the recommendations in this section and Appendix B.

### 5.4.1 Pruning

All pruning shall be conducted in accordance with the standards outlined in *ANSI A300: Standard Practices for Tree, Shrub and other Woody Plant Maintenance* (latest edition) and *ANSI Z133.1 The American National Standards Institute Standard for Safe Working Practices In and Near Trees* (latest edition).

All tree pruning shall be performed by an individual with a Tree Surgery License issued by the State of Mississippi. We recommend that in addition to state licensure, the individual performing this work be an ISA Certified Arborist (International Society of Arboriculture).

Proper pruning corrects defects that could create safety hazards and decrease the lifespan of trees. The following defects are wholly or partially correctable when regular pruning is performed on young and medium-aged trees:

- Multiple leaders
- Branch unions with included bark
- Rubbing branches
- Pest-infested branches
- Deformed branches
- Low, codominant stems
- Long branch stubs
- Dead branches
- Dense canopy
- Clustered branches
- Topped trees
- Lion's-tailed trees
- Root loss
- Branchless trunks
- Side branches longer than the leader
- Water sprouts
- Double leaders

The following tree pruning strategies should be included in the Old Capitol Green tree care program:

#### 5.4.1.1 **Young Trees (<10 yrs old)**

- Establish strong structure by developing and maintaining one dominant trunk
- Shorten aggressive low branches
- Space main branches along trunk by shortening others
- Remove dead branches
- Eliminate touching branches
- Prune cycle 1x per year.

#### 5.4.1.2 **Medium-Aged Trees (10-30 yrs old)**

- Maintain or establish one dominant trunk by reducing length of others
- Shorten branches below lowest permanent limb
- Shorten low branches that will be in the way later
- Prevent stems on low branches from growing up into the permanent canopy
- Space main branches 18 to 36 inches apart by shortening others
- Reduce length of over-extended branches
- Remove dead branches
- Thin edge of canopy
- Eliminate touching branches
- Prune cycle 1x per 3 years.

#### 5.4.1.3 **Mature Trees (>30 yrs old)**

- Remove dead branches
- Minimize potential hazards by reducing length of over-extended limbs
- Thin branches from the edge of the canopy to reduce wind pressure
- Remove as little live tissue as possible to accomplish objectives
- Prune cycle 1x per 5-6 yrs

#### 5.4.2 **Mulching**

Trees should receive mulch as indicated in Appendix B. Application of mulch should conform to guidelines described in 5.3.1 Do not mulch against trunks.

#### 5.4.3 **Root Treatment**

Trees should receive a root treatment that consists of the injection of air into the soil to provide subterranean fracturing and deep root aeration. The treatment should also include the injection of a nutrient and mycorrhizal fungi mixture appropriate for the tree and its condition. Each tree in the landscape would benefit from this treatment, however, we have limited our current recommendation to trees rated as either fair or poor in the tree inventory. See Appendix B.

## 6 **Irrigation**

### 6.1 **All Areas**

- Monitor the moisture levels around all ornamental plants including, but not limited to trees, lawn, shrubs, and groundcovers. Report problems (including brown spots or saturated areas) to on-site management during normal maintenance visits.
- Fix irrigation system leaks and broken or misdirected heads as needed on every site visit.

## 6.2 Spring Start-up

- Open the main valve(s), inspect and adjust all sprinkler heads, re-program and check battery backup in controller, and troubleshoot the entire system.
- Test rain sensor and zone coverage while running.
- Set automatic programs. Post spring/summer/fall schedules (runtimes x days / zone) and train staff as needed to monitor through season.

## 6.3 Checks and Repairs

- Once per month inspect entire irrigation system. Irrigation inspections shall include the following:
  - Activation of each zone to inspect for valve function, lateral breaks, damaged heads, coverage or anything else that would indicate any malfunction of the irrigation system.
  - Adjust irrigation heads for proper coverage.
  - Adjust automatic controller to establish frequency and length of watering periods for seasonal requirements and water restrictions.
  - Runoff of water from irrigation systems into or onto streets, sidewalks, stairs, or gutters is not permitted. Immediately shut down the irrigation system and make adjustments, repairs, or replacements as soon as possible to correct the source of the runoff.
- Do not over-water plantings. Use multiple-start times and short run times to prevent runoff. Do not allow run-off from any irrigation.
- Rain sensors: Install rain shut-off devices where possible. If no rain shut-off device exists, grounds manager should turn off irrigation at first sign of rain.
- Maintain the irrigation system, including cleaning of filter screens yearly or more often as needed, and flushing pipes.

## 6.4 System Repair

- Regardless of the cause of damage, take immediate action to prevent further damage by shutting off the damaged part of the irrigation system and commencing with hand watering as needed. The following items are considered to be minor repairs: damaged or clogged sprinkler nozzles, adjustment of sprinkler patterns or arcs, adjustment of sprinkler position (reorient; raise, lower, or straighten sprinkler head), replacement of clogged, broken, or missing barbed-style drip emitters, replacement or repositioning of drip distribution tubing smaller than 1/2 inch or 15 mm diameter. Any replacement of irrigation system components shall be made with materials of the same manufacturer and model as the original equipment.
- All repairs to the system shall be identical to the original installation, unless approved otherwise in advance by the owner's authorized representative. If a change to the installation will result in lower future maintenance costs, less frequent breakage, or an increase in public safety, request authorization to make the change from the owner's authorized representative.
- For safety, do not install sprinklers on risers above the ground level, even if the risers are flexible. Always use spring-operated, pop-up style, sprinkler heads. Sprinkler heads are available with pop-up heights up to 12 inches (30 cm) above ground level. If the

existing sprinklers are mounted on above-ground risers, the replacements shall be pop-up type sprinklers. No exceptions.

- Annually submit recommendations for changes to system that would improve water efficiency while meeting the plants' needs.

## 6.5 Winterization

- Turn off water supply at main shutoff valve or backflow preventer.
- If drain valve is installed on system, open drain valve to allow water to drain from all pipes. In addition, open each zone valve.
- Turn off controller.

## 7 Glossary

**ANSI A300** The American National Standards Institute standard for pruning trees and shrubs in the landscape.

**ANSI AZ60.1** The American National Standards Institute standard for nursery stock.

**ANSI Z133.1** The American National Standards Institute standard for safe working practices in and near trees.

**Arborist** A person with technical knowledge of tree care practice gained through experience and training.

**Architectural pruning** Shapes and maintains trees to a specific form and size with regular pruning.

**Balancing** Removes branches to redistribute weight.

**Best management practice (BMP)** The best available treatment, considering the benefits and drawbacks, based on current knowledge.

**Biological Control** Use of natural enemies such as parasitoids, predators, or pathogens to control a pest.

**Branch** A stem arising from a larger stem; a subdominant or subordinate stem; the pith in true branches has no connection to the parent stem.

**Branch angle** The angle formed in the union between stem and branch.

**Branch arrangement** Orientation and distribution of branches along a trunk.

**Branch bark ridge** A more or less commonly occurring raised area of bark tissue in the union of two branches or two stems or in the union of branch and stem.

**Branch collar** A swelling at the base of a branch where it joins the trunk or larger branch resulting from overlapping trunk and branch tissue.

**Branch stub** The part of the branch beyond the collar inadvertently left following branch removal.

**Branch union** The place where two branches or stems join or where a branch meets a trunk. See *crotch*.

**Broad-spectrum activity** Refers to pest control materials that kill a wide diversity of pests.

**Bypass pruner** A tool that pushes a sharp blade through a twig past a hooked or curved metal anvil.

**Callus** Undifferentiated, meristematic tissue with little lignin formed by the cambium layer, callus can form sprouts.

**Canker** A depression or opening in the bark usually caused by a fungus or bacterium.



**Canopy** The portion of the tree with foliage from the lowest branch to the topmost part of the tree; synonymous with crown.

**Central leader** A dominant stem located more or less in the center of the canopy.

**Certified arborist** An arborist who has passed an exam and receives, on a regular basis, continuing education administered by the International Society of Arboriculture.

**Chain saw** A power tool designed to cut through large branches and stems.

**Chlorosis** Yellowing of plant tissues; often refers to yellowed leaves with green veins.

**Clean (cleaning)** Removes dead, broken, rubbing, or diseased branches and foreign objects; could also include removing or subordinating weakly-attached branches.

**Clear trunk** The lower portion of a trunk lacking lateral branches.

**Climbing spurs** Sharp, pointed devices strapped to a climber's lower legs used to assist in climbing trees.

**Clustered branches** Branches that are closely spaced, originating from nearly the same position on the trunk.

**Codominant stem** A stem growing at about the same rate, and with nearly the same diameter, as another stem originating from the same union; often the piths are connected in the union.

**Collar** See *branch collar*.

**Collar cut** See *removal cut*.

**Contaminant** Any substance that can harm the environment.

**Crotch** See *branch union*

**Crown** See *canopy*.

**Cultural problems** Too little or too much sunlight, water, fertilizer, air, pest infestations, or other factors resulting in poor growth.

**Curtain** Creates a flat wall-like surface of foliage and twigs with regular shearing.

**Decay** Degradation of tissue caused by biological organisms; the orderly breakdown of tissue resulting in strength loss.

**Decurrent** Round-headed tree form; no leader to the top of the canopy in an open landscape without pruning.

**Defects** Cracks, poor branch or trunk structure, included bark, and other conditions that can reduce a plant's utility or value.

**Defoliation** Loss of leaves.

**Directional pruning** Guides the tree to grow in a certain direction by removing live branches from another portion of the tree.

**Dogleg** Typically, an S-shaped bend in a tree trunk.

**Dominant leader/trunk** The one stem that grows much larger than all other stems and branches; at least 1/3 bigger than lateral branches located nearby.

**Double leader** Two codominant stems originating more or less in the center of a tree and jointly assuming the role of the leader.

**Drop cut** Making three cuts, beginning with an undercut, to remove a branch to prevent bark tearing.

**Drop-crotch cut** See *reduction cut*.

**Drought tolerant** Drought tolerant is used to describe plants capable of withstanding long periods of dry weather.

**Edge trees** Trees with access to sunlight from only one side that grow more on that side.

**Eradication** Removes branches with pest infestations or disease.

**Erosion** The wearing away of the land surface by water, wind, ice, or other geological processes.

**Excurrent** Conically shaped tree form with a dominant leader or trunk extending to the top of the tree.

**Fail** To break or fall.

**Feature trees** Trees located by themselves with few other trees nearby surrounded by turf, ground cover, or shrubs.

**Flush cut** A destructive pruning cut made on the trunk side of the branch bark ridge or through the collar.

**Formal hedge** A shrub maintained as a sharply defined geometric shape by shearing regularly.

**Ground water** That part of the subsurface water which is in the zone of saturation.

**Growth** Irreversible increase in either mass or size of cells, occurring in living organisms

**Hand pruners** Mechanical, single-handed pruners designed to cut twigs up to about 1/2 inch diameter.

**Hardiness rating** Rankings of growing zones within the United States based on limits of annual minimum temperatures, with the purpose of indicating which plants can survive winter in each area of the country.

**Hazardous condition** A condition in a tree that could result in injury to people or damage to property.

**Hazard reduction** Reduces potentially hazardous conditions.

**Hazardous waste** A waste that is a solid or liquid material with certain properties that could pose dangers to human health, property, or the environment.

**Heading cut** A type of pruning cut that prunes a shoot no more than 2 years old back to a bud; cutting an older stem back to a lateral branch less than 1/3 the diameter of the cut stem; cutting a stem to an indiscriminate length.

**Healthy** Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.

**Heavy metals** Elements such as mercury, lead, nickel, zinc, and cadmium that are of environmental concern because they can accumulate in the food chain, and in high enough concentrations, be toxic to life.

**Hedging shear** A two-handed mechanical or power tool designed to cut many shoots at once.

**Impermeable** Not permitting the passage of liquids or gasses.

**Impervious surface** Material which is nonabsorbent and sheds fluid.

**Included bark** Bark pinched or embedded between two stems or between a branch and trunk preventing formation of a branch bark ridge; an indication of a weak union; a crack in the union.

**Infiltration** The movement of water from the surface downward through the soil.

**Informal hedge** A shrub maintained by making heading or reduction cuts only on the longest shoots, 6 to 18 inches back inside the outer edge of the hedge.

**Inoculation** Type of biological control in which small numbers of natural enemies are released over a long time period. Or, the initial contact of a plant pathogen with a plant.

**Interfering branches** Crossing, rubbing, or upright branches that have the potential to damage tree structure and/or health.

**Internode** The area between lateral branches or buds.

**IPM (Integrated Pest Management)** The management of pest populations below levels that cause economic damage by using a compatible balance of biological, cultural, chemical, genetic, and other control methods.

**Large wound** A wound that can lead to defects.

**Large-maturing tree** A tree that grows to a height or spread greater than about 40 feet.

**Latent bud** A suppressed bud lying just beneath bark, capable of forming a shoot, that grows enough each year to stay even with the bark.

**Lateral branch** A stem arising from a larger stem.

**Lateral pruning (cut)** See *reduction*.

**Leader** A stem that dominates a portion of the canopy by suppressing lateral branches.

**Leader training process** The technique that leads to development of one leader.

**Light duration** Length of time plants are exposed to light.

**Light intensity** Amount of radiation that reaches a plant.

**Light quality** Spectral composition of light.

**Limb** A large branch that is among the biggest on a tree.

**Lions-tailing** The improper practice of removing all of most secondary and tertiary branches from the interior portion of the canopy leaving most live foliage at the edge of the canopy.

**Local infection** Small area of infection that usually stays contained near the infection site.

**Lopper** A tool best suited for cutting branches once they have been removed from a tree; a tool with two long handles used to cut stems on shrubs up to an inch diameter.

**Main branches** Those that are the largest several on the tree. See also *scaffold limbs*.

**Maintenance** Actions that preserve the health of plants after installation.

**Major limbs** See *scaffold limbs*.

**Matching trees** A set of trees of the same species or cultivar with like sizes and shapes.

**Mature trees** Trees that have reached at least 75 percent of their final height and spread.

**Maximum critical diameter** The largest diameter pruning cut you are willing to make on a certain species.

**Multiple leaders** A group of two or more leaders or trunks with a similar diameter.

**Natural tree form** The form that develops in the tree's native habitat without disturbance from human activities.

**Neglected tree** A poorly formed tree that has not been pruned for some time, or that has never been structurally pruned.

**Open landscape** An area with few trees within a few dozen feet.

**Ornamental tree** Those that never reach a large size.

**Over-mature trees** Trees that have reached their final height and spread and are declining in vigor.

**Overthinning** Removal of too much foliage typically from the interior portion or lower portion of the canopy.

**Parasite** Any organism that lives in or on another organism, at the expense of the host.

**Parent branch (or parent stem)** A main branch or stem from which smaller lateral branches arise.

**Permanent branches (permanent limbs)** Those that will remain on the tree for many years, perhaps until maturity.

**Permanent canopy** The portion of the tree that will remain for a long time.

**Pesticide** Any chemical agent used for control of specific organisms such as insecticides, herbicides, and fungicides.

**Phloem** Food-conducting tissue of a plant consisting of sieve tubes, companion cells, parenchyma, and fiber.

**Photosynthesis** Plant function in which carbon dioxide, water, and light are used to produce carbohydrates and oxygen.

**Pinching** The equivalent of heading performed on a soft young stem.

**Plant culture** How plants are grown and maintained in the landscape.

**Plant pathogen** Living agent capable of causing disease in a plant host.

**Pollarding** The specialized trimming technique used to maintain a tree at a specified height with regular heading to the exact same position; not the same as topping.

**Poor structure (form)** Branch and trunk architecture resulting in a canopy form that could lead to premature failure of a tree part.

**Potentially hazardous** See *hazardous condition*.

**Preventative arboriculture** Tree care practices and techniques incorporating strategies designed to prevent problems from occurring on trees in urban and suburban landscapes.

**Preventative tree care** See *preventative arboriculture*.

**Primary branches** Branches attached directly to the trunk.

**Pruning** Removal of plant parts.

**Pruning cycle** The interval of time between each pruning.

**Pruning dose** The amount of live tissue removed at one pruning; can be used in a whole-tree sense, or on one stem only.

**Pruning objectives** What is to be accomplished by pruning, for example, to create and maintain strong structure by guiding a tree's architecture.

**Pruning types** Includes clean, thin, reduce, raise, balance, risk reduction, restore, directional prune, vista, root prune, eradicate, and structural pruning.

**Raise (raising)** Provides vertical clearance under canopy.

**Reduce (reduction)** Decreases height or spread on entire tree, or one section only, using reduction cuts; also referred to as reduction or reduction pruning.

**Reduction cut (drop-crotch cut)** Reduces the length of a branch or stem back to a live lateral branch large enough to assume the apical dominance--this is typically at least one-third the diameter of the cut stem.

**Regular pruning** Pruning at more-or-less set interval, such as yearly or every five years.

**Regulation** Tendency of an insect or mite pest population to be maintained at a relatively constant level by the action of density-dependent factors.

**Removal cut** Removes a branch from the trunk or parent branch.

**Resistance** Ability of a plant to avoid damage by a pest

**Respiration** Plant function in which stored carbohydrates are converted to energy.

**Restore (restoring, restoration)** The process of improving the structure of a tree that was previously topped, damaged, vandalized, or overthinned.

**Retention** The process of storing runoff in a manner such that all or a significant portion of the water filters into the ground rather than being released to a surface water body.

**Root collar (root crown, root flare, trunk flare, flare)** The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

**Root problems (defects)** Conditions in the root system that could lead to poor health, or plants falling over such as circling roots, cut roots, decayed roots, no trunk flare, and deep planting.

**Rounding over (roundover)** Reducing the size of a tree by pruning the outer edge of a canopy with small-diameter (typically less than 2 inches) heading cuts; diameter of the cuts are typically small compared to a tree that was topped.

**Runoff** Rainwater flowing over the land surface to the drainage system or waterway. Source of pollution when it carries sediment, toxic substances, or other contaminants.

**Sapling** A young tree about 1 to 3 years old

**Scaffold limb** A branch that is among the largest in diameter on the tree.

**Secondary branches** Branches growing from primary branches.

**Seedling** A young tree less than about 1-1/2 years old.

**Sensitive area** Stream corridors, wetlands, floodplains, shorelines, and steep slopes.

**Shade tree** Those that grow to be more than about 35 feet at maturity.

**Shearing** The practice of making multiple heading cuts to wood less than about a year old.

**Shears** A tool used to cut many small diameter stems at once.

**Shoot** Stem or branch and its leaves, especially when young.

**Shrub** Woody plant with mature height approximately less than 15 feet.

**Single-leadered tree** A tree with a dominant trunk.

**Slow release nitrogen** A form

**Small-maturing tree** A tree that reaches about 25 to 30 feet in height at maturity.

**Solvent** An organic chemical such as ammonia, acetone, benzene, methylene chloride, toluene, trichloroethane, and tetrachloroethylene. Solvents are used in products such as strippers, cleaners, spot removers, degreasers, thinners, and oil-based paints.

**Standards** Industry accepted definitions and principles.

**Stem** A slender woody structure bearing foliage and buds that give rise to other stems.

**Stem bark ridge** Raised bark in the union of two stems.

**Stomata** Pores in the epidermis of the plant through which gas exchange occurs.

**Storm drainage system** A network of pipes and channels for carrying storm and surface waters (not domestic, industrial, and commercial waste waters) to surface waterbodies such as streams and lakes, or to infiltration systems.

**Stormwater** The portion of rain or snowfall that does not naturally filter into the ground or evaporate, but flows overland or through channels or pipes into a defined channel, or a retention/detention facility.

**Structural pruning** Pruning that influences the orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems resulting in a strong tree.

**Stub** The piece of branch left beyond the collar after a removal cut.

**Subordination (subordination pruning)** Removing the terminal, typically upright or end portion of a parent branch or stem to slow growth rate so other portions of the tree grow faster.

**Sucker** Shoot arising from the roots.

**Sunscald** A flattened, dried, or sunken area of the bark resulting from overexposure to the sun.

**Susceptibility** Likelihood that a plant will be damaged by a pest.

**Swale** A grass-lined channel. More specifically, a natural or constructed waterway (usually broad and shallow, covered with erosion-resistant grasses) used to convey surface runoff.

**Taper** The thickening of a stem or branch toward its base.

**Temporary branch** A branch that will remain on the tree for only a short period; not a permanent limb.

**Tertiary branches** Branches growing from secondary branches.

**Thatch** A matted layer of dead vegetation at the base of lawn grasses that prevents the absorption of water and nutrients.

**Thin (thinning)** Removes lateral branches from the edge of the canopy; increases light and air penetration, or reduces weight by removing branches primarily from the outer edge of the canopy.

**Thinning cut** See *removal cut*.

**Tipping** Similar to topping, except heading cuts are made through smaller diameter branches toward the outer edge of the canopy; may be called pencil pruning on some small-maturing trees when cuts are made through pencil-diameter branches.

**Topping** An inappropriate technique to reduce tree size that makes heading cuts through a stem more than 2 years old; a type of pruning cut that destroys tree architecture and serves to initiate discoloration and perhaps decay in the cut stem.

**Translocation** Movement of nutrients or pathogens through the plant.

**Transpiration** Evaporation of water vapor from foliage.

**Transpiration** Movement of water vapor out of the plant.

**Tree** Single and multi-stemmed plants with mature height approximately greater than 15 feet.

**Tree assessment** The process of determining what actions should be taken to improve plant health and reduce risk. Should be performed by a certified arborist.

**Tree habit** The form or shape taken on by the canopy.

**Trimming** Clipping the ends of young branches using heading cuts; see *tipping*.

**Trunk** The main woody part of a tree beginning at the ground and extending up into the canopy from which primary branches grow.

**Trunk flare** 1.) The area at the base of the plant's trunk where it broadens to form roots. 2.) The area of transition between the root system and trunk.

**Turgor** Tension from internal components giving a cell a swollen or distended appearance.

**Understory plant** Plant located under the canopy of existing trees or shrubs.

**Union (crotch)** The junction between stem and branch or between stems.

**Vector** Agent that moves a pathogen to a plant.

**Vigorous branches** Those that grow at a fast rate compared to most other branches on the tree; aggressive branches.

**Vista pruning** A combination of pruning types including thinning, raising, and others designed to enhance a view.

**Water sprouts** Stems arising from interior branches often growing upright and vigorously, often as a result of a stress such as over-pruning, drought, or root damage.

**Watershed** A geographic area within which all surface water drains into a particular body of water.

**Weak crotch (union)** A union with included bark; a union that is relatively weak compared to other unions.

**Witches' broom** Broom-like or massed proliferation caused by a dense clustering of branches on woody plants.



**Wound closure** The process of forming callus and woundwood over a wound such as a pruning cut.

**Wound dressing** A substance, solution or formulation developed for application over a recent pruning cut.

**Woundwood** Differentiated woody tissue forming around a wound, such as a pruning cut. See *callus* for comparison.

**Xylem** Water-conducting tissue of plants, often referred to as wood.

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## Appendix A: Fertilization

### A.1 Landscape Areas

As part of our sampling methodology, we divided the site into distinct landscape areas based on the particular type of vegetation growing. Where man-made borders such as sidewalks exist, area boundaries were determined by the location of these. In a few instances, an area border exists without an obvious man-made delineation and were determined based on the presence of trees. Each landscape area was given an alphanumeric code. The codes for each area are indicated on the Old Capitol Green Maps #1 and #2 (Figures A-1 and A-2). These area codes are used in the fertilization schedule.

### A.2 Fertilizer Schedule

The fertilizer schedule was developed based on recommendations from the MSU Soil Testing Laboratory for soil sampled from each delineated landscape area. See Table A-1.

#### A.2.1 Crop

The predominant type of plant in each area will determine the fertilization and management regime for that area. In most areas of turf, though there are multiple species of grass present, there is one that is predominant; the management recommendations are tailored towards the predominant turf type in each area.

#### A.2.2 Soil pH

The pH was measured as a part of the overall soil testing. The only requirements for adjusting pH are for area C26. The recommendation is to apply 100 pounds of lime per 1000 square feet. Lime may be applied to dry foliage anytime during the year and watered into the soil. However, do not apply more than 50 pounds in a single application--spread the second application six weeks after the initial application. Use ground lime only, passing through a 100 mesh sieve; do not use dolomitic lime.

#### A.2.3 Rate

The rate on the fertilizer schedule refers to the number of pounds of the indicated fertilizer to apply per 1000 square feet.

#### A.2.4 Macronutrients

The fertilizer formulations (Nitrogen Phosphorus Potassium ratio) listed on the schedule are as follows:

Formulation	Fertilizer Name	Notes
24-0-11	The Andersons Turf Fertilizer*	Slow release nitrogen with 2% Iron
0-20-0	Super Phosphate	
0-0-60	Muriate of Potash	

\* At least one-half of the nitrogen component must be comprised of a slow-release water insoluble nitrogen (WIN). Acceptable categories include ureaform, urea-formaldehyde products, triazones, IBDU, sulfur-coated urea, and polymer-coated nitrogen.



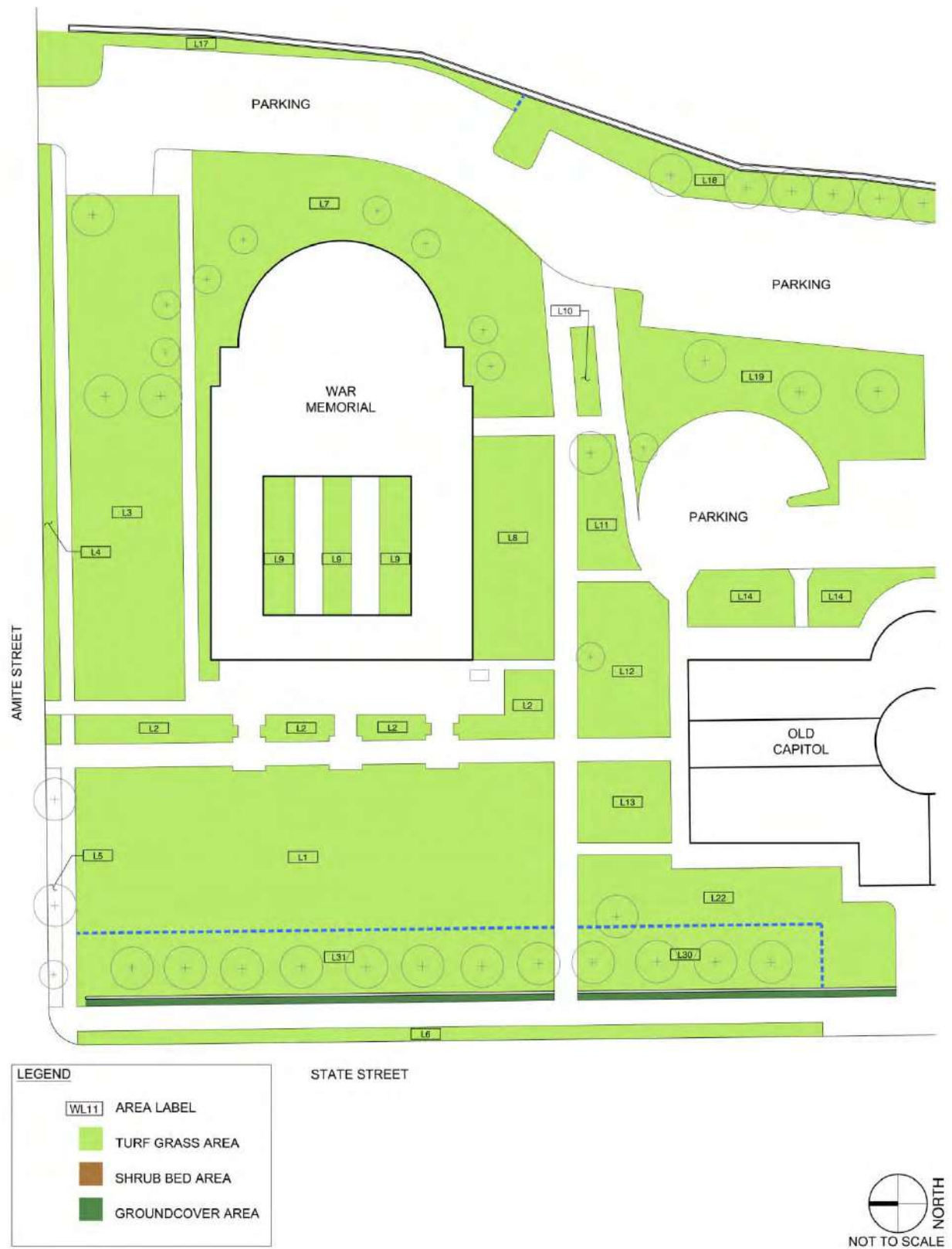


Figure A-2: Old Capitol Green Map #2

Table A-1: Fertilization Schedule

Area	Crop	pH	March			April			May			June			August						
			Fertilizer			Fertilizer			Fertilizer			Fertilizer			Fertilizer						
			Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K			
C1	Zoysia	6.7				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						1.7	0	0	60	1.2	0	0	60	1.2	0	0	60				
C2	Zoysia	6.4				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						1.7	0	0	60	1.2	0	0	60	1.2	0	0	60				
C3	Zoysia	7.0				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						1.2	0	0	60	1.2	0	0	60	0.2	0	0	60				
C4	Hybrid bermuda	6.6				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0	2.2	0	0	60								
C5	Hybrid bermuda	7.7				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0	1.2	0	0	60	1.2	0	0	60	0.2	0	0	60
C6	Hybrid bermuda	6.8				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						1.7	0	0	60	1.2	0	0	60	1.2	0	0	60				
C7	Zoysia	7.4				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
C8	Zoysia	6.7				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0												
C9	St. Augustine	6.7				2.8	24	0	11	4.3	24	0	11	0.0	0	0	0	0.0	0	0	0
						3.0	0	0	60	1.2	0	0	60	0.0	0	0	0	0.0	0	0	0
						5.3	0	20	0												
C10	Hybrid bermuda	6.1				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
C11	Hybrid bermuda	6.3				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0	1.2	0	0	60	1.2	0	0	60	0.2	0	0	60
C12	Hybrid bermuda	7.6				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0	1.2	0	0	60	1.2	0	0	60	0.0	0	0	0
C13	Hybrid bermuda	7.5				4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
						5.2	0	20	0	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60

Area	Crop	pH	March			April			May			June			August			
			Fertilizer			Fertilizer			Fertilizer			Fertilizer			Fertilizer			
			Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K
C14	Hybrid bermuda	5.8					2.8	24	0	11	2.8	24	0	11	4.3	24	0	11
							2.7	0	0	60	3.0	0	0	60				
							4.9	0	20	0	5.3	0	20	0				
C15	Hybrid bermuda	6.8					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							1.7	0	0	60	1.2	0	0	60	0.0	0	0	0
C16	Hybrid bermuda	6.2					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							1.7	0	0	60	1.2	0	0	60	0.0	0	0	0
C17	Hybrid bermuda	7.3					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							5.2	0	20	0	2.2	0	0	60				
C18	Hybrid bermuda	6.9					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							1.7	0	0	60	1.2	0	0	60				
C19	Hybrid bermuda	7.0					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
C20	Hybrid bermuda	7.6					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							5.2	0	20	0	1.2	0	0	60	0.0	0	0	0
C21	Hybrid bermuda	6.2					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							5.2	0	20	0	1.2	0	0	60	0.2	0	0	60
C22	Hybrid bermuda	7.2					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							1.7	0	0	60	1.2	0	0	60				
C23	Hybrid bermuda	6.0					2.8	24	0	11	2.8	24	0	11	4.3	24	0	11
							2.7	0	0	60	3.0	0	0	60	0.0	0	0	0
C24	Hybrid bermuda	7.7					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							5.2	0	20	0	1.7	0	0	60	1.2	0	0	60
C25	Hybrid bermuda	6.0					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11
							0.9	0	0	60	1.2	0	0	60	0.2	0	0	60
							5.2	0	20	0								

Area	Crop	pH	March						April						May						June						August								
			Fertilizer						Fertilizer						Fertilizer						Fertilizer						Fertilizer								
			Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K	Rate	N	P	K					
C26	St. Augustine	5.7					2.8	24	0	11																4.3	24	0	11						
							3.0	0	0	60																1.2	0	0	60						
							5.3	0	20	0																									
							2.8	24	0	11																		4.3	24	0	11				
C27	St. Augustine	6.1					3.0	0	0	60																									
							5.3	0	20	0																									
							4.3	24	0	11																		4.3	24	0	11				
							0.9	0	0	60	1.2	0	0	60													1.2	0	0	60					
C28	Hybrid bermuda	6.0					5.2	0	20	0																									
							4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	
							0.9	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	
							5.2	0	20	0																									
C29	Hybrid bermuda	7.1					4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	
							0.9	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	
							5.2	0	20	0																									
							4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	
C30	Hybrid bermuda	7.0					0.9	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	
							5.2	0	20	0																									
							4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	
							0.9	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	
C31	Hybrid bermuda	6.2					5.2	0	20	0																									
							4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	4.3	24	0	11	
							0.9	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	1.2	0	0	60	
							5.2	0	20	0																									



## Appendix B: Tree Inventory & Management

We conducted a tree inventory and basic visual assessment in concert with the ISA Certified Arborist listed below:

David Fulgham, ISA Certified Arborist #SO-5802-A  
Fulgham's Inc.  
P.O. Bo 3187  
Tupelo, Mississippi 38803  
662-255-5127

As part of this inventory, all trees on site were assigned an identification number and their locations denoted on tree inventory maps (See Figure B-13 and Figure B-14). The complete inventory is shown in Table B-2. The inventory identifies each tree according to species, and includes the current tree size (diameter), a brief description of findings and recommendations, a rating of tree condition, and a checklist of both damage found and recommended mitigation strategies for each tree.

Our inventory revealed a total of 81 trees on the site (82 are indicated on the inventory, but one tree has been removed). The trees were assessed according to their condition and ranked as good (G), fair (F), poor (P), or hazardous (H). Most (56.8%) of the trees were ranked as in good condition, followed by 19.8% in fair condition, 13.6% in poor condition, and 9.9% (8 trees) in hazardous condition. All trees ranked as hazardous are in such condition due to girdling of the trunk by the initial planting guy-wire remaining on the tree far too long.

Trees indicated as hazards should be removed immediately, as they represent a threat to both people and property.



Figure B-3: Example of trunk damage due to guy-wire



Figure B-4: Close-up of trunk damage due to guy-wire

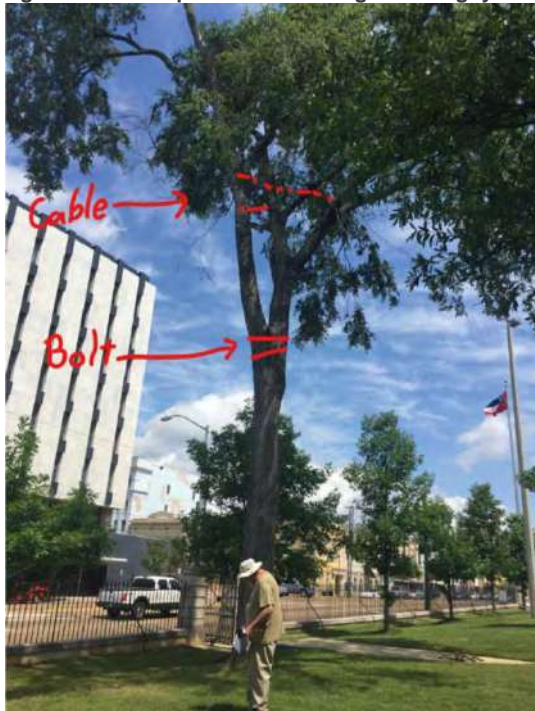


Figure B-5: Tree with co-dominant stems and included bark. Needs bolting and cabling. Tree ID #60



Figure B-6: Example of tree needing deadwood removal.



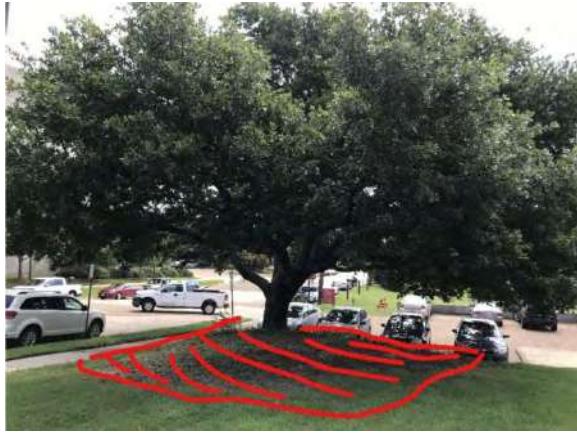


Figure B-7: Mature tree that could benefit from application of mulch. Tree ID #8



Figure B-8: Mature tree that could benefit from the application of mulch. Tree ID #29



Figure B-9: Young tree that has lost its central leader.



Figure B-10: Example of tree without proper pedestrian clearance. Lowest limb above pedestrian walkway must be no lower than 6'-8".



Figure B-11: Vehicular clearance issues along the Pearl Street Bridge



Figure B-12: Voluntary tree seedlings (weeds) are obscuring signs along Pearl Street. In this picture, the sign directing visitors to the Old Capitol Museum is blocked.

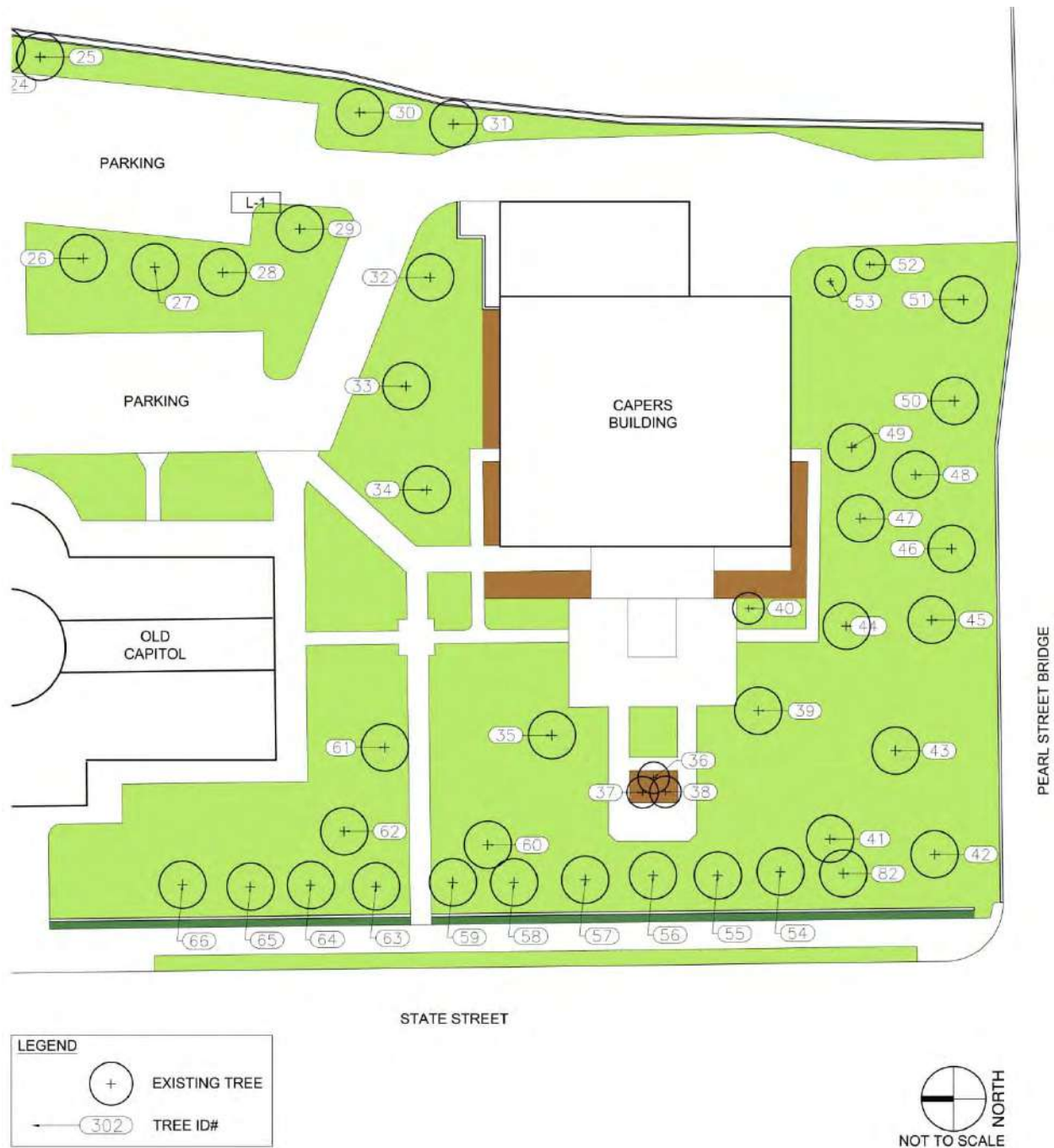


Figure B-13: Tree Inventory Map #1



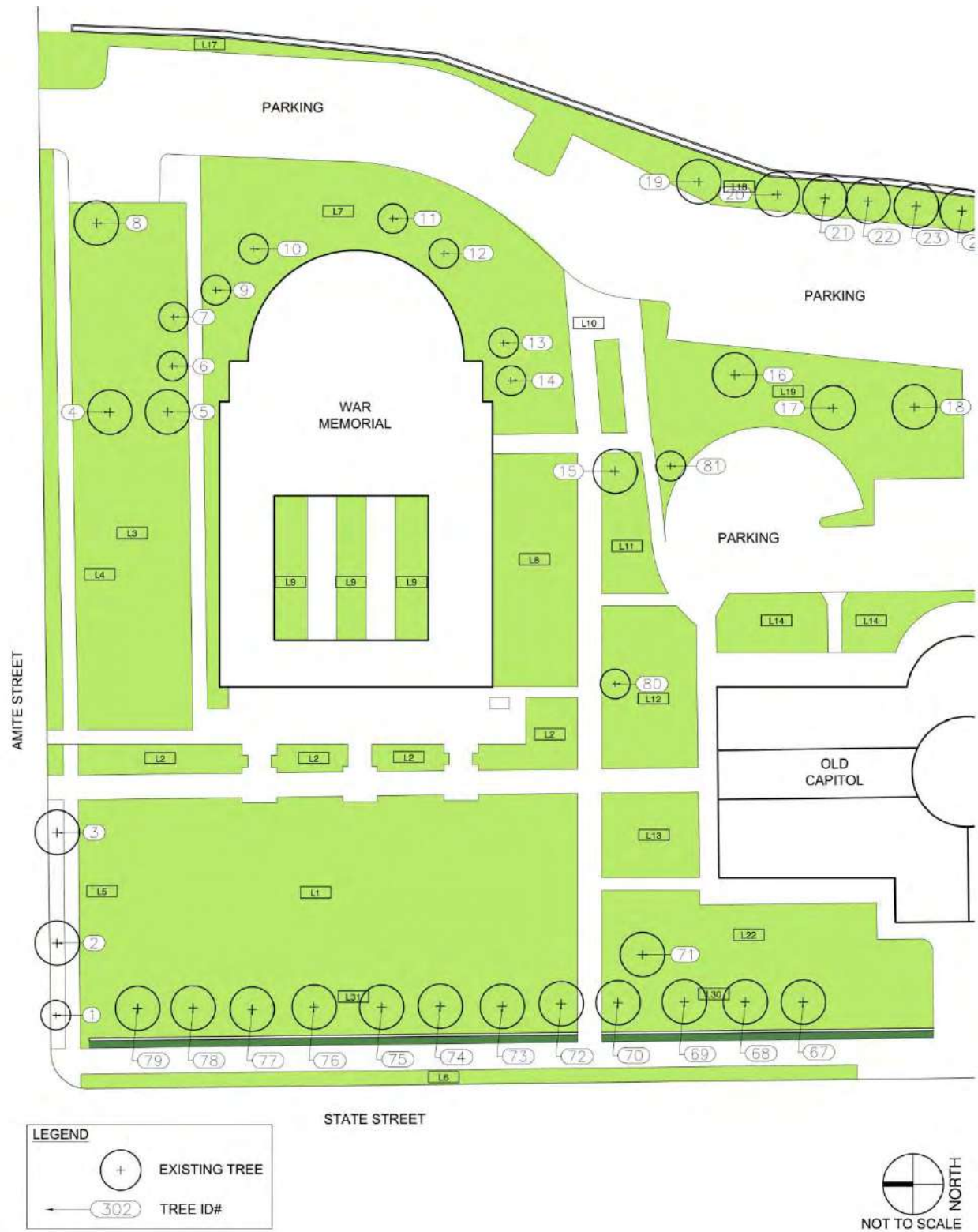


Figure B-14: Tree Inventory Map #2

Table B-2: Tree Inventory and Management Recommendations

					Damage				Management											
					Compaction	Root	Flare	Trunk	Canopy	Deadwood removal	Load Reduction	Height Reduction	Prune Cycle	Root Treatment	Bolt	Cable	Site Modification	Insecticide	Fungicide	Removal
Tree I.D.	Species	DBH (in)	Notes	Condition																
1	Crape Myrtle <i>Lagerstroemia</i> sp.	10	manage for metal damage in trunk, remove metal if possible, historic marker	P				x						x						
2	Pin Oak <i>Quercus palustris</i>	24.75	monitor for sidewalk disturbance, prune dieback, compaction	P	x					x				x						
3	Live Oak <i>Quercus virginiana</i>	17.25	thin, dieback, compaction	P	x									x						
4	Southern Magnolia <i>Magnolia grandiflora</i>	21.5	thin, dieback, compaction, girdling roots, install mulch ring	P	x		x							x						
5	Southern Magnolia <i>Magnolia grandiflora</i>	17	thin, dieback, compaction, girdling roots, install mulch ring	P	x		x							x						
6	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	compaction, good condition, kill grass install mulch ring	G	x															
7	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	compaction, good condition, kill grass install mulch ring	G	x															
8	Live Oak <i>Quercus virginiana</i>	32.5	thin, compaction, showing new growth	F	x									x						
9	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
10	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
11	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
12	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
13	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
14	Foster's Holly <i>Ilex</i> x <i>attenuata</i>	6	kill grass, install mulch ring	G										x						
15	Southern Magnolia <i>Magnolia grandiflora</i>	15	severe dieback, needs pruning, root treatment 3x/year	P						x				x						
16	Oak <i>Quercus</i> sp.	6	chlorosis, crown dieback, trunk girdled by anchor wire, fungal infection, remove	H				x												x
17	Water Oak <i>Quercus nigra</i>	10.5		G																
18	Willow Oak <i>Quercus phellos</i>	8	remove, trunk girdled by anchor wire	H				x												x
19	Water Oak <i>Quercus nigra</i>	39.5	dead wood over parking, prune, apply mulch	F						x				x			x			
20	Willow Oak <i>Quercus phellos</i>	6	cable in branch, phototropic growth, possibly remove due to trunk defect.	G				x												
21	Water Oak <i>Quercus nigra</i>	5	sucker growth, trunk girdled by anchor wire, remove	H				x	x											x
22	Already removed		n/a																	
23	White Oak <i>Quercus alba</i>	7	trunk girdled by anchor wire	H				x												x
24	Willow Oak <i>Quercus phellos</i>	9.5	dieback, chlorosis	F						x				x						

					Damage		Management													
					Compaction	Root	Flare	Trunk	Canopy	Deadwood removal	Load Reduction	Height Reduction	Prune Cycle	Root Treatment	Bolt	Cable	Site Modification	Insecticide	Fungicide	Removal
Tree I.D.	Species	DBH (in)	Notes	Condition																
25	Water Oak <i>Quercus nigra</i>	8.5		G																
26	Southern Red Oak <i>Quercus falcata</i>	6.5		G																
27	Water Oak <i>Quercus nigra</i>	12	possibly remove due to trunk defect.	H					X											X
28	Willow Oak <i>Quercus phellos</i>	8	possibly remove due to trunk defect.	H					X											X
29	Live Oak <i>Quercus virginiana</i>	29.5	dieback, compaction, kill grass, mulch, root treatment 3x/yr	F	X					X				X						
30	Willow Oak <i>Quercus phellos</i>	21	good, root treatment 2x/yr	G																
31	Water Oak <i>Quercus nigra</i>	19	good, remove visible signs of t-post, root treatment 2x/yr	G					X									X		
32	White Oak <i>Quercus alba</i>	5.5		G																
33	White Oak <i>Quercus alba</i>	6	good, remove visible signs of t-post, mulch	G					X									X		
34	White Oak <i>Quercus alba</i>	8	trunk cable, sucker growth, possibly remove due to trunk defect.	H																X
35	Willow Oak <i>Quercus phellos</i>	26	slight dieback, deadwood removal over path, root treatment 2x/yr	F						X				X						
36	Crape Myrtle <i>Lagerstroemia</i> sp.	20	clean base, remove suckers, maintain as tree form, no topping or pollarding	F									X	X						
37	Crape Myrtle <i>Lagerstroemia</i> sp.	10	clean base, remove suckers, maintain as tree form, no topping or pollarding	F									X	X						
38	Crape Myrtle <i>Lagerstroemia</i> sp.	10	clean base, remove suckers, maintain as tree form, no topping or pollarding	F									X	X						
39	Pin Oak <i>Quercus palustris</i>	11	deadwood, prune, root treatment 2x/yr, mulch	P						X				X				X		
40	Yaupon Holly <i>Ilex vomitoria</i>	6	root treatment 2x/yr	P									X	X						
41	Southern Magnolia <i>Magnolia grandiflora</i>	24.5	dieback, slight stress, compaction	G	X					X										
42	Southern Magnolia <i>Magnolia grandiflora</i>	37	good, dieback, slight stress, clean base	G	X								X							
43	Southern Magnolia <i>Magnolia grandiflora</i>	26.5		F										X						
44	Live Oak <i>Quercus virginiana</i>	30.5	thin dieback, deadwood, root treatment 2x/yr, mulch	F						X				X				X		
45	Live Oak <i>Quercus virginiana</i>	19	thin dieback, deadwood, root treatment 2x/yr, mulch	F						X				X				X		
46	Live Oak <i>Quercus virginiana</i>	26	deadwood removal, include pruning ht. above road	G						X		X								
47	Live Oak <i>Quercus virginiana</i>	33	poison oak, deadwood removal, clean base	G					X		X									
48	Live Oak <i>Quercus virginiana</i>	28.5	deadwood, clean base	G						X										

					Damage			Management												
					Compaction	Root	Flare	Trunk	Canopy	Deadwood removal	Load Reduction	Height Reduction	Prune Cycle	Root Treatment	Bolt	Cable	Site Modification	Insecticide	Fungicide	Removal
Tree I.D.	Species	DBH (in)	Notes	Condition																
49	Live Oak <i>Quercus virginiana</i>	30	deadwood, clean base	G							x									
50	Southern Magnolia <i>Magnolia grandiflora</i>	10 & 13	codominant, clean base	G																
51	Southern Magnolia <i>Magnolia grandiflora</i>	13 & 14	cable codominant	G													x			
52	Crape Myrtle <i>Lagerstroemia</i> sp.	10	deadwood, clean base, root treatment, maintain as tree form, no topping	F											x					
53	Crape Myrtle <i>Lagerstroemia</i> sp.	10	deadwood, clean base, root treatment, maintain as tree form, no topping	F											x					
54	White Oak <i>Quercus alba</i>	5		G																
55	White Oak <i>Quercus alba</i>	5		G																
56	White Oak <i>Quercus alba</i>	5		G																
57	White Oak <i>Quercus alba</i>	5		G																
58	White Oak <i>Quercus alba</i>	5	root treatment 2x/yr	P											x					
59	White Oak <i>Quercus alba</i>	5		P											x					
60	Elm <i>Ulmus</i> sp.	24	deadwood, compaction, long-term ht. reduction, cable and bolt	F	x						x	x	x	x	x	x				
61	Pin Oak <i>Quercus palustris</i>		deadwood removal, root treatment 2x/yr, mulch	F							x				x			x		
62	White Oak <i>Quercus alba</i>	5		G																
63	White Oak <i>Quercus alba</i>	5		G																
64	White Oak <i>Quercus alba</i>	5		G																
65	White Oak <i>Quercus alba</i>	5		G																
66	White Oak <i>Quercus alba</i>	5		G																
67	White Oak <i>Quercus alba</i>	5		G																
68	White Oak <i>Quercus alba</i>	5		G																
69	White Oak <i>Quercus alba</i>	5		G																
70	White Oak <i>Quercus alba</i>	5		G																
71	White Oak <i>Quercus alba</i>	5		G																
72	White Oak <i>Quercus alba</i>	5		G																



					Damage					Management										
					Compaction	Root	Flare	Trunk	Canopy	Deadwood removal	Load Reduction	Height Reduction	Prune Cycle	Root Treatment	Bolt	Cable	Site Modification	Insecticide	Fungicide	Removal
Tree I.D.	Species	DBH (in)	Notes	Condition																
73	White Oak <i>Quercus alba</i>	5		G																
74	White Oak <i>Quercus alba</i>	5		G																
75	White Oak <i>Quercus alba</i>	5		G																
76	White Oak <i>Quercus alba</i>	5		G																
77	White Oak <i>Quercus alba</i>	5		G																
78	White Oak <i>Quercus alba</i>	5		G																
79	White Oak <i>Quercus alba</i>	5	stunted or new tree, root treatment 2x/yr	F										x						
80	Crape Myrtle <i>Lagerstroemia</i> sp.	10	slight prune, maintain as tree form, no topping or pollarding	G						x										
81	Crape Myrtle <i>Lagerstroemia</i> sp.	10	dieback, slight prune, maintain as tree form, no topping or pollarding	F						x				x						
82	White Oak <i>Quercus alba</i>	5.5	remove	H																x

## Appendix C: Task Prioritization

In order to guide the implementation of the recommendations in this management plan, we have ranked main tasks in order of their importance. This ranking is not absolute and may need to be adjusted as time passes. However, those at the top of the ranking should be performed prior to those lower on the list.

Priority	Task
1	Tree hazard mitigation; remove trees indicated as hazards
2	Make changes to care of Asiatic Jasmine as indicated in 5.2.2
3	Tree pruning to remove dead wood
4	Tree pruning to permit pedestrian and vehicular clearance
5	Begin pruning young trees yearly to develop strong structure
6	Begin root treatment program for all trees rated as in fair or poor condition
7	Implement recommendations for turf care as described in 5.1
8	Implement recommendations for shrub and shrub bed care as described in 5.3
9	Put all trees on regular assessment and pruning cycle as indicated in 5.4.1