

Tree Management Plan

Presented to



Departments of Parks and Recreation
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Notice of Disclaimer

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Executive Summary

The Town of Florence, Arizona's Department of Parks and Recreation is responsible for the long term care and health of the community's urban forest. In the fall of 2005, Florence commissioned Davey Resource Group to conduct an inventory and evaluate the current condition of each tree. Based on an analysis of this information, an effective planning and management program can be created for this valuable resource.

This report details the findings of the tree inventory and explores and recommends some future tree management options. Key findings include:

- There are 320 trees under the jurisdiction of the Department of Parks and Recreation in the town of Florence, including vacant planting sites and stumps.
- Ash and mesquite trees make up half of the trees maintained by Florence. Twenty-two other species make up the remaining population.
- The majority of trees are small or medium-sized (less than 24 inches in diameter).
- Approximately nine out of ten trees are in Good condition.
- There are eight trees recommended for removal. Of these, six (1.88%) are recommended for Priority 1 Removal and two (.63%) are recommended for Priority 2 Removal.
- Thirty-four (10.63%) trees are recommended for Large Routine Prune and 274 (85.63%) trees are recommended for Small Routine Prune. Four (1.25%) trees are recommended for Stump Removal.

Grounds Tree Management Recommendations

In addition, DRG developed a three year management plan to direct the care of Florence's trees. Key recommendations include:

- Perform the recommended removal of eight priority trees as soon as possible.
- Implement a continual routine maintenance cycle for the tree population to ensure pruning of all trees every three years.
- Establish a tree planting program to maintain species diversity, seasonal interest, and to establish replacements for significant landscape trees.
- Continue to educate personnel about proper mulching, pruning, general arboricultural treatments and techniques, and preventing mechanical damage to trees with mowing equipment and string trimmers.

Introduction

The existing landscape packages the structures and environment offered to residents and visitors to the Florence, Arizona. A well-maintained collection of vegetation is important for maintaining the beauty of the town and shady atmosphere of the town parks. Trees provide beauty and aesthetic gratification through the seasons and soften and enhance structures and hardscape features.

Without proper planning and maintenance, trees can unfortunately become a costly liability. Improper selection of tree species can lead to high maintenance costs for insect and disease control, litter clean-up from excessive cones or fruit, or frequent pruning to remove broken branches. Trees can also become hazards to people if broken branches fall. A tree care program based on proper species selection, plant health care practices, and proactive maintenance will maximize the benefits offered by trees while minimizing costs and liabilities.

Trees provide significant economic benefits as well, including increased real estate values, and a more attractive setting in which to work. Trees provide shade and act as windbreaks, helping to decrease commercial energy consumption. When properly maintained, trees return overall benefits and value to the grounds environment far in excess of the time and money invested in them for planting, pruning, protection measures, and removal.

In order to maintain the community of trees in the town, some understanding of the trees as individuals and as a group must exist. Species composition, average life expectancy for each species, general health and condition, and treatment recommendations all provide information on the trees as individuals and as a group. This information can be used to identify the general characteristics of the tree community. These trends allow an understanding of the tree community and subsequently can be used to address management concerns.

To enhance the vegetation management program for the Department of Parks and Recreation in Florence, Davey Resource Group was originally contracted by Mr. Ken Lawrence, Grants Coordinator for the Town of Florence. The inventory data were then used to construct this management plan to guide future tree care and management.

Statement of Purpose

The purpose of this document is to provide a five-part tree management plan, which provides guidelines for the future, allows for more effective use of tree care funds, and allows for accurate budget projections.

Scope

This document provides a comprehensive action plan for Florence's Parks and Recreation Department's tree population. The management plan includes an analysis of the current tree population and its maintenance needs, as well as long-term management recommendations.

The plan discusses the findings of the complete tree inventory performed by Davey Resource Group. The scope of this discussion includes:

- A summary and analysis of the tree inventory.
- A description of the tree population's species composition.
- A discussion of the general condition of the trees.
- Specific maintenance recommendations for each tree, including pruning or removal recommendations to reduce potential safety hazards, as well as developing cyclical pruning programs.

Goals

The Tree Inventory Management Plan discussed in this document is intended to achieve the following goals:

- Gain an overall understanding of the inventoried tree population in terms of genus and species composition.
- Identify and recommend remedial action for trees with structural (or other) defects that could cause them to be (or become) potential safety risks to citizens, visitors, vehicles, and property.
- Analyze the individual and overall conditions of the inventoried tree population.
- Establish a tree safety pruning and removal program that will alleviate all potentially hazardous conditions.
- Establish a three-year cyclical Routine Pruning Program.
- Establish a Training Pruning Program for all immature and newly-planted trees as needed.

Evaluating and Updating This Plan

This plan is initially intended to provide town forest management guidelines for the next three years. In order to measure the effectiveness of the program implementation and goal achievement, a method for evaluation should be followed.

Specific accomplishments can be measured in comparison to the plan's stated goals and recommendations. These include:

- Evaluating the number of trees pruned annually in the Routine Pruning Program.
- Annually comparing the number of trees planted to those removed.
- Establishing a Training Pruning Program and evaluating the number of trees pruned each year in relation to the stated goal.

By annually evaluating the progress of the above components of the program, appropriate adjustments can be made in areas that are not meeting the stated goals. Note that any changes that occur in the town tree population (i.e., removals, pruning, etc.) should be updated regularly in the Work Planning software as well.

Chapter 1: Methodology

Summary

This chapter provides a description of the procedures used by Davey Resource Group in conducting the Town of Florence, Arizona Department of Parks and Recreation tree inventory. Definitions and methodology of data collection are provided to give the reader a total understanding of the inventory process.

Definition

A “tree” is defined as a woody perennial dicot (generally with one main trunk) having the potential to exceed at least 20 feet in height. However, within this narrow definition are many important factors. Trees can be deciduous (losing leaves seasonally) or evergreens (maintaining leaves throughout the year). Some trees grow well in shade while others perform best in open sun. Trees may require well-drained soils or may thrive on moist sites. Trees may grow quickly or slowly and growth rate may affect the strength of the wood and resistance to storm damage. Trees may be disease-prone or relatively disease-free. In short, there are many types of trees and many factors that go into choosing the appropriate tree for any given site.

Data Collection

Attributes for individual trees include:

- Tree Location
- Tree Genus and Species Identification
- Tree Diameter
- Tree Height
- Number of Tree Trunks
- Tree Condition
- Tree Maintenance Objective
- Treatment Required
- Presence of Disease
- Presence of Pests/Insects
- Irrigation System Installed
- Additional Comments (Field Notes)

The inventory was conducted using a Microsoft Windows XP Tablet PC Edition Computer. Inventory data was plotted by a Davey Resource Group arborist using proprietary GIS-based data collection software.

Tree Genus and Species Identification

All trees are identified by botanical name (genus and species) and common name. The identification of trees by botanical names ensures the correct scientific identification of each tree species, while the use of common names provides a readable format for anyone reading this management plan.

Tree Diameter

Diameter at breast height (DBH) is a standard forestry measurement generally taken at 4.5 feet above the ground. Each tree's diameter range was taken visually by the Davey arborist. In borderline cases, trees were measured with a diameter tape.

Tree Height

Tree height ranges were taken visually by the Davey arborist. Tree height classes observed are:

- 0-15 feet
- 15-30 feet
- 30-45 feet
- 45-60 feet
- Greater than 60 feet.

Tree Trunks

During the inventory, each tree was evaluated for the total number of trunks present. For trees with multiple trunks, the two largest trunk DBHs were recorded. If there were more than two trunks, the largest DBH was recorded and the sum of the remaining trunks was also recorded in a second data field.

Tree Condition

Condition indicates the current state of a tree's health, structural soundness, overall shape, and growth rate. Symptoms of poor condition include discoloration, decay, dieback, decreased internodal length, and/or disfigured or necrotic stems or roots. To some extent, condition class is also a reflection of the life expectancy of the tree. Crown development, trunk condition, major branch structure, twig growth rate, insects/diseases, and root condition are all considered. In general, the condition of each tree is recorded as one of the following categories adapted from the rating system established by the *International Society of Arboriculture (ISA)*:

Excellent

100% - 90% condition class. The tree is nearly perfect in condition, vigor, and form. This rarely used category is generally applicable to small-diameter trees that have been recently transplanted and are well established.

Very Good

89% - 80% condition class. Overall, the tree is healthy and satisfactory in condition, vigor, and form. The tree has no major structural problems, no mechanical damage, and may only have insignificant aesthetic, insect, disease, or structure problems.

Good

79% - 61% condition class. The tree has no major structural problems, no significant mechanical damage, may have only minor aesthetic insect, disease, or structure problems, and yet is in good health.

Fair

60% -41% condition class. The tree may exhibit the following characteristics: minor structural problems and/or mechanical damage, significant damage from non-fatal or disfiguring diseases, minor crown imbalance or thin crown, and/or stunted growth compared to adjacent trees. This condition also includes trees that have been topped but show reasonable vitality and no obvious signs of decay.

Poor

40% - 21% condition class. The tree appears unhealthy and may have structural defects such as co-dominant stems, severe included bark, severed trunk and/or decay. A tree in this category may also have severe mechanical damage, crown dieback, or poor vigor threatening its ability to thrive. Trees in poor condition may respond to appropriate maintenance procedures, although these procedures may be cost-prohibitive to undertake.

Critical

20% - 1% condition class. The tree has a major structural problem that presents an unacceptable risk, has very little vigor, and/or has an insect or disease problem that is fatal and, if not corrected, may threaten other trees on the property.

Dead

0% condition class. This category refers to dead trees only.

Tree Maintenance Recommendations

Maintenance recommendation information is collected to provide a basis for determining and prioritizing the primary maintenance recommendations of the inventoried tree population on the grounds. This information is useful for preparing accurate budgets and for developing maintenance schedules whether the work is performed by in-house crews or contracted out to local tree care companies.

Tree Removal Recommendations

Removals are categorized based on the urgency of the need for removal. The categories are Priority 1 Removal and Priority 2 Removal. Each is briefly described below:

Priority 1 Removal

Trees designated as Priority 1 Removal are dead or have serious structural defects that cannot be effectively or practically remedied and present a potential hazard to the public. Such defects include, but are not limited to, extensive trunk decay and severely decayed or weakened V-crotches where the potential for failure is high.

Trees in this category present an immediate, yet unpredictable, potential risk of damage to people or property. These trees should be removed as soon as possible.

Priority 2 Removal

Trees designated as Priority 2 Removal are dead or have one or more defects that cannot be cost-effectively or practically remedied but, because of the size or location of the tree, there is diminished hazard to the public as compared to Priority 1 Removal trees. Representative defects include, but are not limited to, extensive trunk decay and severely decayed or weakened V-crotches, or where the removal of limbs for safety concerns would drastically impact the tree form or its visual usefulness. These trees should be removed after trees in the Priority 1 Removal category have been removed.

Tree Pruning Recommendations

Pruning recommendations are categorized based on the reason pruning is recommended or needed. The categories are Priority 1 Prune, Large Routine Prune, Small Routine Prune, and Training Prune.

Pruning categories in this report can be separated into Safety Pruning Recommendations and Cyclical Pruning Recommendations.

Safety Pruning Recommendations

These recommendations are categorized based on the presence of potentially hazardous conditions in the tree canopy that can be remedied through pruning. Trees in these two safety categories require pruning to remove deadwood and/or broken branches that pose a potential risk and may result in personal injury or property damage. Priority One Prune (described below) addresses the priority of the work based on the size of the tree limbs needing pruning.

Priority 1 Prune

Trees in this category require pruning to remove deadwood and/or broken branches that pose a potential risk that could result in personal injury or property damage. This category is used for any tree(s) with broken, hanging, dead, or otherwise potentially dangerous limbs greater than four inches in diameter which are in danger of failing or trees with a significant number of dead branches (which may be less than four inches in diameter) that require removal.

Cyclical Pruning Recommendations

These recommendations provide a guide to trees that currently have no potentially hazardous conditions that need to be remedied through one of the safety pruning recommendations above. Instead, the following three pruning categories are designed to include those trees that would benefit from a regular cyclical pruning program wherein they would be periodically inspected and pruned on a recurring basis. These categories are Large Routine Prune, Small Routine Prune, and Training Prune.

Large Routine Prune

Trees receiving this designation include those that would benefit from regular maintenance to limit the development of future problems or trees that have problems that may become future risks if not corrected. This category is for large growth habit trees that have minor amounts of deadwood less than two inches in diameter and/or with correctable structural problems. Large growth habit trees that will eventually obstruct or interfere with pedestrian or vehicular traffic clearance, traffic control devices, lines of sight, or overhead traffic lines are also included in this category.

Small Routine Prune

Trees receiving this designation include mature small growth habit trees that can be evaluated and pruned from the ground. This includes all trees that will not likely attain a height greater than 30 feet when mature. Trees with this classification will require routine horticultural pruning to correct structural problems or growth patterns that would eventually obstruct vehicular or pedestrian traffic or interfere with buildings.

Training Prune

This includes newly-planted trees, immature trees, and some mature trees less than 20 feet in height that need structural pruning in order to reduce the development of future problems. These trees have correctable structural problems or minor amounts of deadwood that pose little or no threat to personal injury or property damage.

Treatment Required

Trees that are recommended for a treatment plan receive this designation. Treatment includes spraying, irrigation, fertilization, or the combination of irrigation and fertilization.

Presence of Disease

Trees that have a noticeable presence of disease receive this designation. The actual symptom, such as the presence of fungi, may not be seen. However, if the tree should show any signs (effect) of a disease (cause), the tree will be noted as having the presence of a disease. This designation is not used unless it is known that the condition of the tree is specifically due to disease.

Presence of Pests/Insects

Trees that have a noticeable presence of a pest or insect receive a positive note under this designation. The pests or insects may not be seen by the inspector; however, if the tree should show any signs (effect) of a pest/insect (cause), the tree will be noted as having the presence of pests/insects. This designation is not used unless it is known that the condition of the tree is specifically due to pests/insects.

Irrigation System Installed

This designation is used for trees that have an irrigation system installed or have some method of receiving irrigation.

Additional Comments (Field Notes)

Any additional comments regarding maintenance, cultivars, condition, disease, location, etc., are included for each tree, when applicable:

- Base decay
- Cable and/or brace
- Co-dominant trunks
- Cabling system present
- Consider removal
- Crown dieback
- Dead leaders present
- Decay fungi present
- Girdling roots
- Hanger(s) present
- Included bark
- Insect pests present
- Large leader or limb decay
- Lighting struck
- Leaning
- Lost main leaders
- Remove extra stems
- Remove poison ivy
- Remove vines
- Root rot
- Trunk wounds

Chapter Two: Tree Population

The Town of Florence has a variety of trees, site conditions, and maintenance requirements. Understanding this system is important for proper decision making regarding species selection and tree care practices. The Tree Population Characteristics section of this report provides insight into the current composition and condition of the inventoried trees in the Florence. This information comes from an analysis of the data collected during the tree inventory phase of the project. The data will be presented and analyzed by the total population of trees managed by the Town of Florence Department of Parks and Recreation. Specific information detailed in this chapter includes:

- **Species Composition and Diversity**
- **Size Class Distribution**
- **General Health and Condition**
- **Tree Maintenance Recommendations**
- **Other Data Fields**
- **Tree Inventory Concerns**

By accumulating and using this information, groundskeepers can forecast trends, anticipate maintenance recommendations, facilitate budgeting for tree-related expenditures, and develop a basis for long-term planning. This is necessary to ensure a stable and diverse tree population for the coming years and to plan for future tree planting operations.

Tree Population Characteristics

The characteristics of the town tree population include species, diameter, height, condition, maintenance objective, and other tree comments where necessary. By identifying the species, diameter, and condition of trees in town, one can learn a sizable amount about the population's composition, relative age, and health. It is important to know the kinds of trees as well as the number of trees present on the grounds. Species composition data are essential because tree species vary considerable in life expectancy and maintenance requirements. The types of trees present in town will greatly affect tree maintenance, activities, and budgets. Similarly, tree diameter and size class data help to define the general age and size distribution of the total tree population or individual species population.

Species Composition and Diversity

Table 1. Species Composition of Town of Florence, Arizona's Trees.

Scientific Name	Common Name	Number	Percentage
<i>Fraxinus velutina</i>	Fan-Tex/Arizona ash	107	33.44%
<i>Prosopis glandulosa</i>	mesquite	56	17.50%
<i>Pinus eldarica</i>	mondell pine	35	10.94%
<i>Acacia stenophylla</i>	shoestring acacia	18	5.63%
<i>Washingtonia robusta</i>	Mexican fan palm	18	5.63%
<i>Citrus aurantium</i>	sour orange	8	2.50%
<i>Pistacia chinensis</i>	Chinese pistachio	8	2.50%
<i>Morus alba</i>	white mulberry	7	2.19%
<i>Cercidium floridum</i>	blue palo verde	7	2.19%
<i>Eucalyptus polyanthemos</i>	silver dollar gum	6	1.88%
Totals		270	84.38%

The inventoried tree population is comprised of 320 trees distributed among 19 genera and 24 species. Table 1 illustrates that ten species account for 90% of the Department of Parks and Recreation's tree population.

In the field of urban forestry, it is generally recommended that no single species should account for more than 10% of the total population. Furthermore, no genus should comprise more than 20% of the total population. Table 1 depicts that *Fraxinus velutina* (Fan-Tex/Arizona ash) comprises approximately 33.44% of the inventoried trees in Florence. Furthermore, Figure 1 (below) shows that the *Fraxinus* (ash) genus accounts for approximately 33% of the Department of Parks and Recreation's total tree population.

The inventory shows that the tree planting efforts for the town of Florence by the Department of Parks and Recreation have resulted in a rather well-mixed species distribution, favoring slightly to *Fraxinus velutina* (Arizona ash). Planting a large number of trees of the same species (monoculture) can lead to catastrophic results. A good example of this situation was the

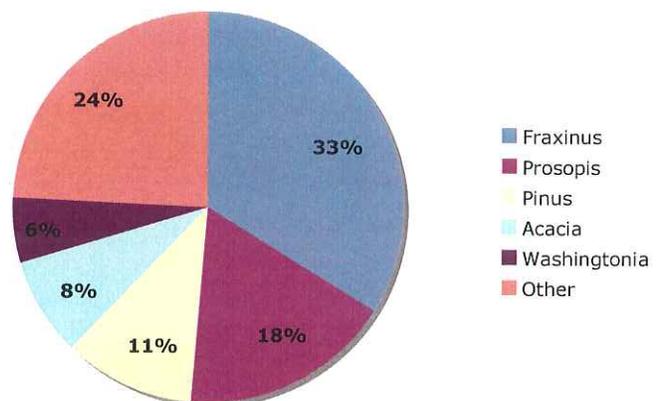


Figure 1. Genus Composition of Florence's Trees.

dominance of American elm (*Ulmus americana*) trees in American cities in the 20th century. When Dutch elm disease (*Olphiostoma ulmi*) arrived in the United States in the 1930s, the resulting tree losses were devastating. Similar scenarios are now foreseeable for the Asian long-horned beetle (*Anoplophora glabripennis* (Motschulsky)) and emerald ash borer (*Agrilus planipennis* (Fairmaire)).

While the use of a limited number of species can simplify the decision-making process for a landscape manager, careful deliberation can benefit the grounds as a whole. A variety of species types can decrease the impact of species-specific pests and diseases by limiting the number of trees that are susceptible. This, in turn, reduces the time and money spent on mitigating problems resulting from any such episodes. Also, a wide variety of tree species may help to limit the impacts from a number of physical events, such as strong storms, wind, flooding, drought, etc.

Ideally, attention should be paid to the type of desired effects various trees can provide. Mature tree size and available growing space must also be considered with a respect to aesthetic effects and the eventual physical impact of the trees on their surrounding environments.

Size Class Distribution

Tree species have different life spans and mature at different diameters, heights, and crown spreads. This means that actual tree ages cannot be assumed from the diameters of the tree. However, general classifications of size, such as small, medium, and large, can be used to describe the general characteristics of the town's tree population. This does not substitute for age classes, which can give the actual age and maturity of the trees but it can provide a general idea of the variability in the tree population.

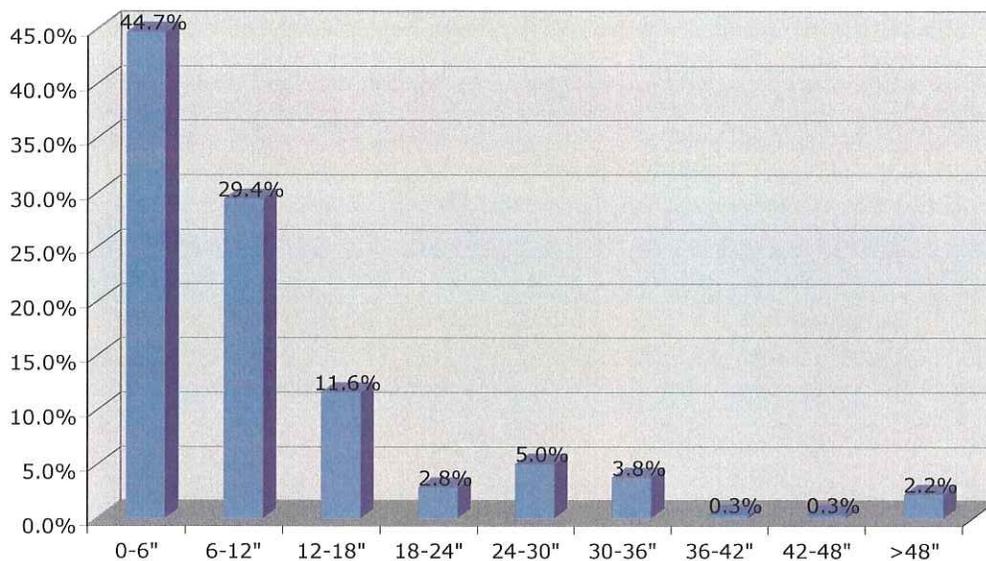


Figure 2. Diameter Size Class Distribution of Town of Florence, Arizona Department of Parks and Recreation Inventoried Tree Population.

As illustrated in Figure 2, small trees, which are six inches or less in diameter, represent approximately 44% of the total tree population inventoried. Ash (*Fraxinus*) trees account for the majority of these trees. It must be understood that “small trees” does not mean that all trees in this class are of small growth habit. For example, the ash trees in this group were fairly young and recently planted. Under normal conditions, these trees can reach a median height of 50 feet.

Species diversity alone is not sufficient to maintain a stable grounds tree population. The extent to which each species is adapted to the conditions in Florence and the local climate will also determine to general health and longevity of the tree population. The many species currently being used in the Town of Florence represent a good group for town tree usage.

It should be noted that young, deciduous trees must be properly pruned to encourage good growth habit and to minimize future maintenance requirements as the trees mature. Though the maintenance requirements are more intensive in young trees, this care can be performed efficiently by ground crews and without costly equipment.

Roughly 44% of the inventoried urban forest falls under the medium-sized classification with a diameter range of 6-24 inches. Ash (*Fraxinus*) and olive (*Olea*) trees dominate this size class.

Large trees, which are 25 inches and greater in diameter, represent approximately 12% of the inventoried tree population. Palm (*Washingtonia*) and pistachio (*Pistacia*) trees dominate this size class.

Keeping the above factors in mind, it becomes clear that planning for tree planting in Florence requires careful consideration of species selection. The small size class should be composed of both long-lived species and smaller, shorter-lived species, addressing the need for future requirements and the desire for such characteristics as spring flowers and fall color. Tree maintenance should be carried out to ensure the health and longevity of the trees, especially those with good maturity potential. This includes fertilizing, watering, mulching, and training pruning when young.

Normal recommendations in grounds forest management call for achieving over time an appropriate age mixture by removing and replanting a certain percentage of trees each year. A good rule-of-thumb for a grounds tree population is 20 : 60 : 20 mix of small, medium, and large trees, reflecting the percentage of trees in each size group and representing a uniform spread of tree ages from young to mature to overmature. By comparison, Florence’s current population 46 : 12 : 44 mix of small, medium, and large trees. Using this approach, a large commercial property can maintain the existing stocking level of its tree resources.

General Health and Condition

The condition of a tree is evaluated by considering several factors including, but not limited to, the root characteristics, trunk, branch structure, canopy, foliage, and presence of pests, among others. Based on these factors, each tree is given a rating based on those defined by the ISA.

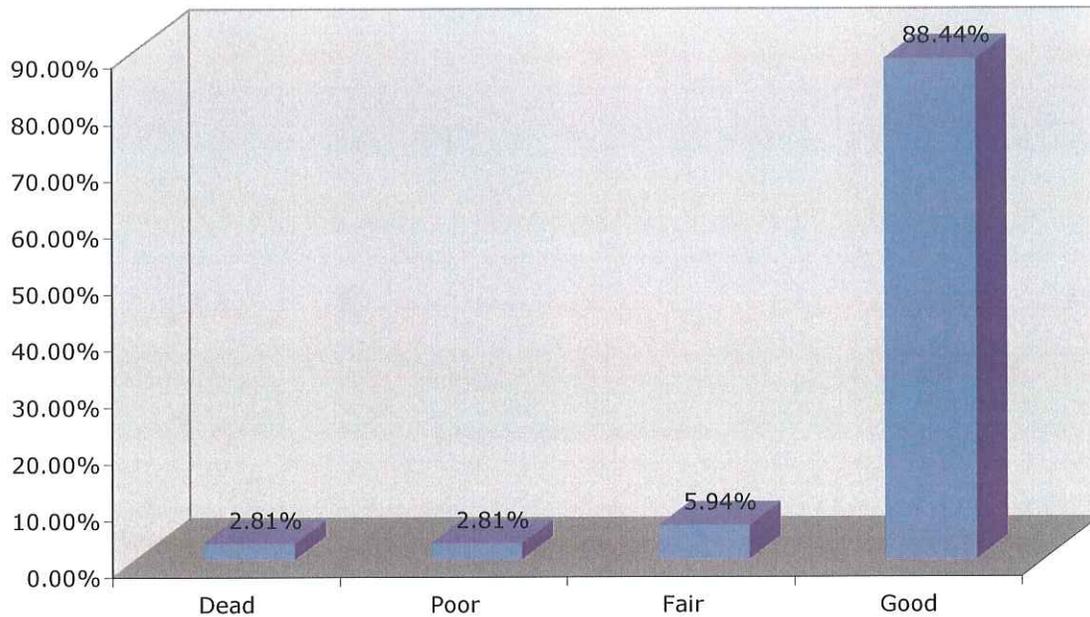


Figure 3. Town of Florence Department of Parks and Recreation Tree Conditions.

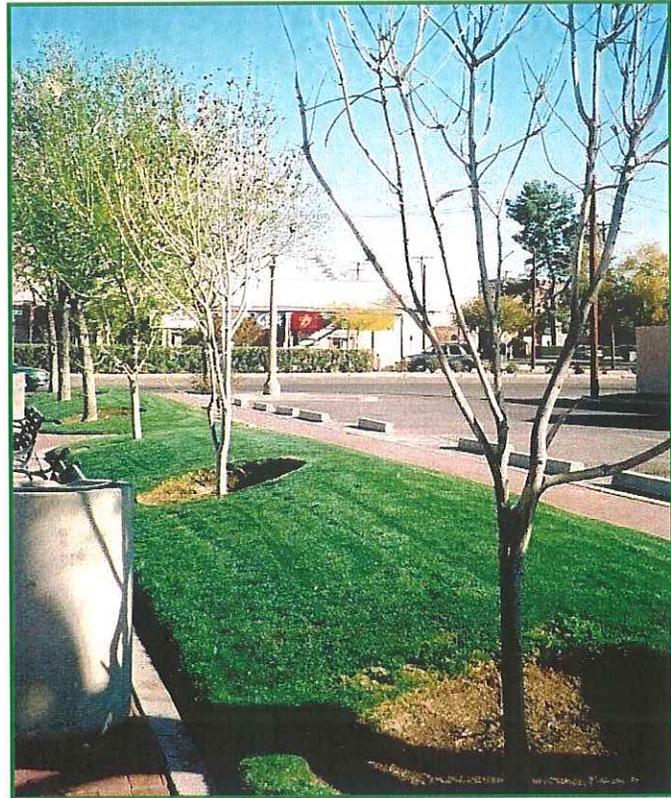
As can be seen in Figure 3, a significant portion of the tree population in Florence is in good health. This is primarily due to the young age group of the trees. Trees in poor condition only comprise approximately 3% of the total inventoried population. Silver dollar gum (*Eucalyptus polyanthemos*) has the highest number of trees listed in poor condition. These trees are all located within Main Street Park.

The poor condition ratings given to mature trees are generally due to visible signs of decline and stress including, but not limited to, decay, dead limbs, sparse branching, or poor structure. Where physical damage has occurred, these trees may also become more susceptible to diseases and other problems.

These kinds of stresses can also make trees more prone to pest problems by providing access to internal wood tissue. In fact, there are certain insect pests specifically drawn to wounded trees. If a tree is already stressed, the additional injury can substantially reduce the tree's ability to sustain defense mechanisms and maintain growth. When trees are in good health, most have the ability to withstand pest or disease problems but, with the onset of stress and/or decline, they are less able to produce sufficient energy for growth and survival and can cease rapidly.

The poor condition rating given to young or newly planted trees is often due to severe physical damage or to a failure to thrive after planting. Young trees can be seriously impacted by physical damage from vehicles, lawnmowers, string trimmers, and poor pruning practices and are often vandalized because of their small size, which makes them an easy target for destruction.

When maintaining town trees, it must be realized that the potential for loss is an important factor in prioritizing treatments and making effective use of available funds. Monitoring the condition of significant trees and making efforts to maintain their health is essential. The loss of trees over time is an inevitable natural process. However, to control the decline, removal and replacement of trees in a timely and cost-effective manner is the goal of the management process.



A row of Fan-Tex ash trees along Main Street appear to be healthier as the ages increase down the row.

Tree Maintenance Recommendations

One objective of the tree inventory was to determine the current appropriate maintenance recommendations for the tree population. The highest priority maintenance recommendations identified pertain first and foremost to public safety. The requirement for specific pruning maintenance or removal was decided upon by the inventory arborist based on the existence of potential safety hazards to persons in the town of Florence. The maintenance activities associated with reducing the risk of injury or property damage include:

- Priority 1 Removal and Priority 2 Removal
- Priority 1 Prune

The other maintenance activities discussed here are:

- Large Routine Prune
- Small Routine Prune
- Training Prune
- Stump Removal
- Replant/Replace

The latter three categories are not high priority safety pruning activities, but rather practices directed at improving the overall health, longevity, and aesthetics of the grounds forest.

The current town tree maintenance requirements have been determined from observations of the trunk, scaffold branches, and canopy of each tree, as well as the trees' location relative to parking lots, recreation areas, sidewalks, utility wires, and signs and buildings.

This section analyzes the removal and pruning requirements noted during the inventory. Recommendations for future maintenance activities are included as part of the discussion of each category. The maintenance requirements can be queried in Davey's TreeKeeper[®] software. Additionally, the next chapter discusses, in detail, the specific prioritization of maintenance work. Maintenance data would be used as a basis for prioritizing activity needs.

Table 2. Town of Florence Department of Parks and Recreation's Tree Maintenance Recommendations.

Maintenance	Number of Trees	Percentage of Trees
Removal Priority 1	6	1.88
Removal Priority 2	2	0.63
Stump Removal	4	1.25
Prune Priority 1	0	0.00
Routine Prune Large Tree	34	10.63
Routine Prune Small Tree	274	85.63
Training Prune	0	0.00
Replant/Replace	0	0.00
Totals	320	100

It is clear from Table 2 that a majority of the tree maintenance work needed on the inventoried trees in the town of Florence are "non-hazardous" pruning activities. Approximately 96% of the total tree population requires routine pruning work. However, since the town of Florence's first priority is safety of its residents and visitors, removal and pruning activities that are considered a high priority will now be discussed.

Tree Removals

Trees fail from natural causes such as disease, insects, and weather conditions, and from physical injury due to vehicles, vandalism, poisoning, and root disturbance, among others. There are three main reason why hazardous urban trees should be removed: (1) to reduce risks to persons and property; (2) to eliminate breeding sites for insects and disease; (3) for aesthetic reasons. As stated above, trees recommended for removal in this inventory are those that may be potential safety risks or are in such poor condition that they are likely to fail or die within the next few years.

Of the town trees inventoried, six (1.88%) are recommended for Priority 1 Removal and two (.63%) are recommended for Priority 2 Removal (Table 2). These trees are comprised of a mixture of pine (*Pinus*), pistachio (*Pistacia*), mesquite (*Prosopis*), orange (*Citrus*), and palo verde (*Parkinsonia*) trees. The majority of these trees are listed as dead and they occur in a variety of diameter classes. The prompt removal of these trees will reduce municipal liability through the decrease likelihood of tree failure.

Recommended tree removals can be queried for in the TreeKeeper[®] software, for ease of identification and location in the Town of Florence, Arizona.

Priority Pruning

Priority 1 Prune is the removal of dead, diseased, or obviously weak, heavy, or hazardous branches which are greater than four inches in diameter. As can be seen in Table 2, none of the trees inventoried in Florence require this type of maintenance.

Routine Pruning

Routine Pruning consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches on the main trunks of trees, as well as those within the canopy area. Three hundred and four (96.26%) of the inventoried trees are candidates for a Routine Prune. A systematic Routine Pruning cycle of all town trees should be implemented to decrease the occurrence of potentially dangerous broken branches and large deadwood. A set of recommended pruning guidelines is provided in Appendix A.

Large Routine Prune includes large growth habit trees requiring routine horticultural pruning to correct growth patterns that would eventually obstruct vehicular or pedestrian traffic or interfere with utility wires or buildings. Trees in this category are currently large enough to require bucket truck access or manual climbing. Large routine pruning is recommended for 34 (10.63%) trees in Florence.

Small Routine Prune includes small growth habit trees requiring routine horticultural pruning to correct growth patterns that would eventually obstruct vehicular and pedestrian traffic or interfere with buildings. Trees in this category may be mature trees, but are small enough that they can be pruned from the ground. Small routine pruning is the most common recommendation for trees inventoried in Florence, with 274 (85.63%) of the trees falling into this category.

The trees requiring Routine Pruning are not generally regarded as presenting an immediate risk of hazard. This will allow the Department of Parks and Recreation to budget and schedule most of its maintenance recommendations in a cost-effective and timely manner. Although many of these recommendations are presently low priority, they can become high priority liabilities if neglected for an extended period of time. Pruning guidelines can be found in Appendix A. To ensure all trees are maintained in a timely manner, a pruning cycle is needed. Davey Resource Group recommends trees are routinely pruned every three years. Once all priority prunes are addressed, these trees will then fall back into the routine pruning category. The number of trees needing routine pruning will then increase.

In general, coniferous trees such as monardella pine (*Pinus eldarica*) do not require cyclical pruning like deciduous trees. Nor do these trees usually require training pruning when young (except in the case of multi-stemmed tree or those with co-dominant leaders).

Training Pruning

Training, or pruning to shape, consists of the removal of dead, dying, diseased, interfering, conflicting, and/or weak branches, as well as selective trimming to direct future branch growth. This maintenance category applies to all trees less than 20 feet in height and is primarily concerned with trees that are young or newly planted.

Trees in this group are of such a size that they can be pruned from the ground with a pole pruner. None of the trees inventoried fell into this category at the time of inventory.

Other Data Fields

- **Treatment**-includes irrigation, fertilization, irrigation and fertilization combined, and spraying.
- **Disease**-includes trees that showed signs and/symptoms of disease. None of the inventoried trees fell into this category.
- **Pests/Insects**-includes trees that showed signs/symptoms of having pests present. None of the trees exhibited any signs/symptoms of pests or insects.
- **Irrigation**-of the 320 trees inventoried, 282 (88.12%) were listed as having an irrigation system installed at the time of the inventory.

Chapter Three: Three-Year Town Tree Management Program

Summary

This chapter details the activities that will constitute a Three-Year Grounds Tree Management Program for the Department of Parks and Recreation. Headlines in this chapter include:

- Priority Tree Maintenance Recommendations
- Routine Pruning Program

In this chapter, a Three-Year Grounds Tree Management Program is described, with specific tree management recommendations which include:

Management Recommendations for Ground Trees

- Perform all Priority maintenance recommendations. This includes all removals and all priority pruning identified in the inventory. This program is designed to alleviate all potential hazards identified in the tree inventory by 2008.
- Beginning in Year Three, implement a continual Routine Pruning maintenance cycle for the grounds tree population to ensure proper pruning every three years.
- A plan for after-care of new tree plantings should be implemented in order to maximize the survival rate. This includes pruning, mulching, and watering.

Priority Tree Maintenance Recommendations

The following tree maintenance recommendations are based on the analysis of the inventoried portion of the town of Florence's tree population in Chapter Two. These recommendations should be followed and used in the development of appropriate and realistic management goals. Implementation of these recommendations will allow the Department of Parks and Recreation to first address the highest priority maintenance recommendations related to resident and visitor safety.

Initially, the Department of Parks and Recreation should concentrate on reducing the potential risks identified in the inventory. This means removing all trees identified as requiring Priority 1 and Priority 2 Removal and pruning all trees identified as recommended for Priority 1 Pruning. A complete list of the maintenance requirements for each tree is located in the Tree Inventory Workbook and can also be queried in the TreeKeeper[®] software.

Useful Life

The useful life of an urban tree has ended when the cost of maintenance is greater than the value added by the tree to the grounds. This can be due to either the decline of the tree's condition and increasing maintenance activities or to the costs of repairing damage caused by the tree's presence.

Decline generally starts when the tree has reached a point where it cannot withstand the stresses imposed by its environment. Restrictive growing space, disease, insects, mechanical damage, pollution, and vandalism, among others, can cause stress. Although

some species are more resistant to these stresses, all trees in an urban grounds setting will eventually decline, either from stress or senescence.

The pattern of decline generally begins with persistent limiting site factors that place the tree in a state of chronic stress. This weakens the tree's natural defenses, leaving it more susceptible to injury from pests or unusual weather, such as a single insect induced defoliation or extreme



The useful life of these Arizona ash trees on Main Street may be lessened due to the restriction of planters.

drought. Because the tree is now stressed, it has difficulty withstanding or combating the circumstance or recovering from such stress. As a result, the tree can become even more vulnerable to insects and diseases that continue to reduce its vigor. Often, the first signs of a problem appear at this point.

The age at which a tree reaches the end of its useful life differs by species and also for certain individual trees within a genus. Slow-growing species, such as Arizona ash (*Fraxinus velutina*) are most valuable when they attain maturity. Fast-growing species such as shoestring acacia (*Acacia stenophylla*) are most valuable as juvenile trees because they provide benefits quickly and become expensive to maintain after they reach maturity.

The end of the tree's useful life can also be reached while the tree is still healthy if it is growing in a limited site. Useful life, in this instance, is the point at which the cost of related maintenance, such as the repair of hardscape damage, exceeds the value added by the tree. For example, a large, fast-growing tree used in a small-dimension, raised planter will lead to a poor root system at an early age that will become worse throughout its lifetime. The useful life of this tree will be reached before it begins to decline. A smaller tree, on the other hand, would probably not exceed the existing grow space dimensions at any point in its life. The end of its useful life would probably be reached only when it started to decline due to senescence. A smaller tree, as a result, would make a better use of this theoretical tree site.

Priority Tree Maintenance Summary

The town of Florence should establish procedures or keeping the tree inventory information current in the TreeKeeper[®] software. Keeping accurate records of work completed on specific tree and tracking tree condition will help do this. Florence's tree inventory will prove to be a valuable tool in organizing, scheduling, and routing the work to be accomplished.

As mentioned earlier, the overall maintenance priorities are:

- Removals – Priority 1 and Priority 2
- Pruning – Priority 1

Large, short-term expenditures are required for trees with these maintenance recommendations. They should be performed as soon as possible, beginning in the first year of the plan's implementation.

A complete list of trees recommended for removal and priority pruning has been included in the Tree Inventory Workbook to expedite their location in the field. These trees can also be queried in the TreeKeeper[®] software. Based on the tree inventory's results, Table 3 provides a summary of the Priority Maintenance Recommendations for the town of Florence's trees.

Davey Resource Group strongly encourages Florence to schedule these activities to occur in as timely a manner as possible in order to begin the reduction of potential safety risks. By doing so, Florence will greatly lessen the potential of injury to residents and visitors, damage to property, and possible liability litigation. Although it would be almost impossible to expect Florence to perform all needed maintenance activities immediately, an organized and systematic program will achieve the needed results in a timely manner and will demonstrate the Center's sincere attempt to keep the grounds trees safe for employees and visitors.

Table 3. Priority Tree Maintenance Requirements by Type and Size Class.

Diameter Class	Number of trees	Priority 1 Removal	Priority 2 Removal	Priority 1 Prune
0-6"	143	0	2	0
6-12"	94	1	0	0
12-18"	37	4	0	0
18-24"	9	0	0	0
24-30"	16	0	0	0
30-36"	12	1	0	0
36-42"	1	0	0	0
42-48"	1	0	0	0
>48"	7	0	0	0
Totals	320	6	2	0

Routine Pruning Program

Routine Pruning is an activity that should take place on a cyclical basis for the entire tree population once all priority maintenance removal and pruning activities have been completed. Since the priority maintenance recommendations described above may be accomplished in the first year, it is recommended that the Routine Pruning Program described here be implemented beginning in the same years if funds exist for the work. If funds do not exist, the Routine Pruning Program can begin in Year Three, after the priority tasks have been completed. This activity is extremely beneficial for the overall health and longevity of the town trees. Through Routine Pruning, potentially serious problems can be avoided because the trees can be closely inspected during this pruning cycle. Proper decisions can be made on declining trees and any trees that are becoming potential hazards can be managed appropriately before any serious incidents occur.

Small Growth Habit Trees

Small Routine Pruning is recommended for mature, small growth habit trees. These species are genetically small trees and usually attain a maximum height of no greater than 25-30 feet but, like all urban trees, require periodic pruning throughout their life span. The primary reason for periodic pruning of small growth habit species is to maintain overall health and vigor through the removal of dead, dying, or diseased branches, as well as branches that may be interfering with the growth of other major branches. By maintaining these trees with periodic Small Routine Pruning, the potential for decay can be minimized and vigor can be maintained by retaining only strong, healthy branches.

A total of 274 (86%) of Florence's trees are recommended for Small Routine Pruning. This is an activity that would be extremely beneficial for the overall health and quality of the town's trees.

Small Routine Pruning can normally be accomplished from the ground with relatively inexpensive equipment. For this reason, the town's crews will be able to easily perform this work with existing equipment. These crews would be responsible for the cyclical trimming of all small trees, as well as the training pruning of young and recently planted trees. Additionally, they can perform clearance trimming work. This is termed "crown raising" (elevating of tree limbs) and will allow vehicles to safely pass in parking lots or pedestrians to walk on sidewalks. Furthermore, the clearing of limbs away from signs, buildings, and lights can be accomplished. Cyclical pruning of large trees will need to be contracted out unless current employees can be trained to do such work.

Three-Year Cycle

Results from the tree inventory indicate that 304 (95%) of the town's trees would be included in a cyclical pruning operation. Since no trees were recommended for Priority Pruning type, this number will remain the same until new plantings are added to this category.

It is suggested that a three-year cycle be implemented so that approximately 102 grounds trees per year are routinely pruned. As happens all too often, tree pruning consists of trimming only if a hazardous situation exists. This management plan

provides the town of Florence with exact numbers concerning Routine Pruning and will serve as a guideline for accomplishing such a program.

Table 4. Routine Pruning Program by Size Class.

Diameter Class (Inches)	Routine Prune (Total Trees)	Routine Prune (Approximate Trees/Year)
0-6"	141	47
6-12"	93	31
12-18"	33	11
18-24"	9	3
24-30"	16	5
30-36"	11	4
36-42"	1	1
42-48"	1	1
>48"	7	2
Totals	312	105

Training Pruning Program

As described previously, training pruning consists of the removal of dead, dying, disease, interfering, conflicting, and/or weak branches, as well as selective trimming to direct future branch growth on trees less than 20 feet in height. For these trees, a Training Prune is used to develop a strong structurally sound tree. Many young trees may have branch structure that can lead to potential problems as the tree grows such as double leaders, many limbs attaching at the same point on the trunk, or crossing/interfering limbs. When trees are small, these problems can be remedied easily and inexpensively. Pruning can be accomplished from the ground with a minimum amount of equipment. If these problems are not corrected while trees are young, they can lead to instances where branches are poorly attached and where decay can develop at the crossing points of interfering limbs. Trees with poor branching become safety hazards as they grow larger and could create potential liability situations for the town of Florence in the near future.

All newly planted trees should receive their first Training Prune three years following planting. No Training Prunes should be performed when a tree is first planted because it is already under stress from transplanting and needs as much of its leaf canopy as possible in order to manufacture food and increase root growth for proper establishment in its new site. Only dead or broken branches should be removed at the time of planting. No trees in the town of Florence were recommended for this type of pruning at the time of the inventory.

Three-Year Cycle

As with the Routine Pruning Program, the Training Pruning Program would also be accomplished on a three-year cyclical basis. As mentioned above, newly planted trees should receive their first Training Prune three years after planting. This work can be accomplished throughout the entire year. Since no bucket truck is required, grounds personnel can perform this work at any time.

Training Personnel

Proper training in young tree structural pruning should be required for all tree crew personnel. Additionally, these workers would require an understanding of the growth habits of the various species being planted, as well as an understanding of tree anatomy and physiology. This training can be received through the International Society of Arboriculture Certified Arborists. The tremendous aesthetic and financial benefits to be gained in the years to come from proper structural pruning of young trees are a strong incentive for educating tree crew personnel concerning proper pruning techniques. Additionally, the added knowledge gained by the Department and Parks and Recreation's grounds personnel could prove to be an incentive in raising the sense of professionalism in their jobs.

Tree Planting

During the inventory process, seven potential planting sites were identified. The location of these trees can be queried in the Work Planning software. Tree species should be selected for their durability and low maintenance requirements. These attributes are highly dependent on site characteristics and local climate, as well as species characteristics. Matching a species to its favored climatic and soil conditions is the most important task when planning for a low maintenance landscape. Trees that are well matched to their environmental conditions are much more likely to resist attack from pathogens and insect pests and will therefore require less maintenance.

In addition to the seven potential planting sites inventoried, there are 79 sites that the Department of Parks and Recreation plans on utilizing for new trees. Of these trees, 12 of them are planned to be Smallis Acacia (*Acacia smallis*), 36 will be Desert Museum Palo Verde (*Cercidium hybrid*), 22 will be Sissoo Tree (*Dalbergia sissoo*), and the remaining 9 will consist of Pink Orchid Tree (*Bauhinia lunarioides*). The addition of these new tree species will contribute to the goal of creating a diverse environment among the trees in Florence.

The Planting Process

A shallow planting hole should be excavated (typically slightly less deep than the height of the root ball) and the hole should be quite wide (three times the diameter of the root ball). Care should be taken so that the root collar of the new tree is at the same level or slightly higher than the surrounding soil grade. In most situations, it is not recommended to add soil amendments to the planting hole as this can lead to differences between texture and soil structure inside the planting hole and through the surrounding soil. Such differences can lead to water being wicked away from or retained in the planting hole. Staking materials should only be used when necessary to keep the tree from leaning due to wind or to prevent damage from pedestrians.

Stakes should be attached to the tree with a loose, flexible material and all staking material and tree wraps must be removed within one growing season.

Mulch should be applied to the soil surface around newly planted trees. Mulch should never be piled up around the root collar (i.e., mulch “volcanoes”), but rather should be pulled away from the root collar. Mulch that buries the root collar provides shelter for fungi, insects, and mammals that could damage the trees. Mulch should be applied to an area three times the diameter of the root ball to a depth of two to four inches. Mulch not only suppresses competition from grasses and weeds, but it also provides a zone where mowing is not needed, thereby keeping mowers and string trimmers safely away from the trunk (thus preventing mechanical damage). Mulch also helps to hold moisture in the surface of the soil where most of the feeder roots are to be established.

Summary and Conclusions

Florence has many trees that add to the beauty of its parks and downtown and provide an atmosphere that is welcoming to visitors and calming to residents. As trees get older, they are less able to withstand stresses that exist in an urban setting and become increasingly susceptible to decline.

Generally stated, Florence's significant issues include:

1. **Potentially Hazardous Trees and Tree Parts.** A hazardous tree is defined through the presence of three factors: (1) there must exist a defective tree, or tree part, that poses a high risk of failure or fracture; (2) there must be a target that would be struck by the tree, such as people or property; and (3) a potential hazard exists when the environment increases the likelihood of tree failure. Such environmental factors could include severe storm events, strong winds, shallow or wet soil conditions, or growing spaces that restrict tree root or crown development.

Situations where injury or property damage has occurred from falling trees are not isolated and are well documented in the media on a regular basis. Along with the potential for personal injury or property damage comes the probability of the responsible parties being held liable for any injuries or damages. Such lawsuits can and have resulted in costly judgments against the defendants.

The Department of Parks and Recreation's primary concern must be the safety of its employees and visitors. Tree removals and pruning are vital part of hazard mitigation. The grounds tree population is mostly in good to fair condition; however, there are large trees with varying degrees of decay existing in the scaffold limbs, trunks, and roots. The three-year plan discussed previously is designed to address the greatest safety risk conditions first. Consideration must always be made of area usage and the threat of falling limbs or trees to persons and property when putting a pruning and removal plan into action. This inventory has provided a prioritization scheme for hazard abatement and it is strongly recommended that the three-year plan be followed accordingly.

2. **Mulching and Preventing Mechanical Damage.** Mechanical damage to the grounds trees will have long-term impacts. Basal injury can open trees to decay organisms and, over time, the original damage can become a substantial stability hazard or can contribute to the decline of the trees. A mulching or herbicide-spraying scheme should be considered in order to eliminate mechanical damage to the roots and trunks of trees. When establishing or maintaining mulch rings around the trees, the use of post emergent herbicides to control weeds or grass encroachment must be carefully applied, especially near thin-barked trees and tree root systems.
3. **Annual Inspection of Trees.** Significant trees greater than 18 inches DBH in high traffic areas should be inspected annually for possible deadwood removal.
4. **Grounds Construction Activities.** Activities such as grading and trenching can lead to root severance and soil compaction, which compromises tree health and

stability. Educating grounds and construction crews about the short- and long-term effects of construction damage, as well as creating and enforcing tree preservation methods, will ensure the health of Florence's trees for years to come.

5. **Tree Planting Efforts.** Tree planting should continue to replace any tree losses in the future and maintain a healthy, mature grounds setting.
6. **Training and Routine Pruning.** Florence should begin and continue Training and Routine Pruning Programs. These programs will allow the proper care of all the young and established trees. Training young trees and routinely pruning established trees will decrease the occurrence of structural problems and potential hazards for Florence's tree population.
7. **Disease and Insect Prone Species.** Approximately 34% of Florence's trees are ash. With such a large amount of trees from only one genus, the potential for an insect or disease to spread is great. With any large population of trees, there will always be insects and diseases present.

Management of trees in the Town of Florence can be challenging. Balancing the recommendations of experts, the wishes of directors and administrators, the pressures of budgetary constraints, the concerns for liability issues, the physical requirements of the trees, and the desires for all of these factors to be met simultaneously is quite difficult. Groundskeepers must carefully consider each issue and balance them with a knowledgeable understanding of trees and their needs so that the beauty of Florence's trees and the health of its trees are maintained.

Appendix A: Recommended Pruning Guidelines

Pruning is the most common tree maintenance procedure. Forest trees grow quite well with little or no pruning but, in landscape situations, tree pruning is often desirable or necessary to remove dead branches, improve tree structure, enhance vigor, or maintain safety. Pruning cuts must be made with an understanding of how the tree will respond to the cut. Improper pruning can cause damage which continues for the life of the tree. This chapter is designed to help the arborist become aware of tree response to the various methods of pruning. Knowledge of the tree's response will help the arborist achieve the goal of a healthy, aesthetically pleasing tree.

Effects of Pruning

Removing foliage from a tree has two distinct effects on its growth. Removing leaves reduces photosynthesis and may reduce overall growth. At the same time, growth that does occur takes place on fewer shoots, so they tend to grow longer than they would have without pruning. This is called shoot invigoration. These principles would be considered when pruning trees and other woody plants.

Reasons for Pruning

Since each cut has the potential to change the growth of a tree, no branch should be removed without a reason. Common reasons for pruning are to remove dead branches, to remove crowded or crossing limbs that may create future structural problems, to eliminate hazards, and to slow growth by removing foliage. Trees may also be trimmed to reduce wind resistance or to increase light penetration. In most cases, tree trimming is of a corrective or preventative nature.

Timing

The best time to prune trees depends on the desired results. As a rule, growth is maximized if pruning is done just before the period of rapid growth, in early spring. Plant growth can be reduced if pruning takes place soon after growth is complete for the season. Most routine trimming and removal of weak, diseased, undesirable, or dead limbs can be accomplished at any time with little effect on the tree. Flowering can be prevented or enhanced by pruning at the appropriate time of the year. Trees that bloom on current season's growth, such as crepe myrtle or linden, are best pruned in winter, prior to leaf emergence, or in late summer after bloom has occurred. Plants that bloom on last season's wood, such as fruit trees, should be pruned just after bloom.

Some references recommend that certain species of trees, such as maples and birches, not be pruned in the early spring when sap flow is heavy. These trees tend to "bleed", or drain sap from the pruning cuts. Although unattractive, research has shown that this has little negative effect on tree growth.

Pruning Cuts

Each cut should be made carefully, at the correct location, leaving a smooth surface with no jagged edges or torn bark. The correct anatomical location is just beyond the branch collar or shoulder. (Figures 8.1 and 8.2)

Large or heavy limbs should be removed using three cuts. The first cut undercuts the limb one or two feet out from the parent branch or trunk. A properly made undercut will eliminate the chance of the branch “peeling” or tearing bark as it is removed. (Figure 8.3) The second cut is the top cut which is usually made slightly further out on the limb than the undercut.

This allows the limb to drop smoothly when the weight is released. The third cut is to remove the stub.

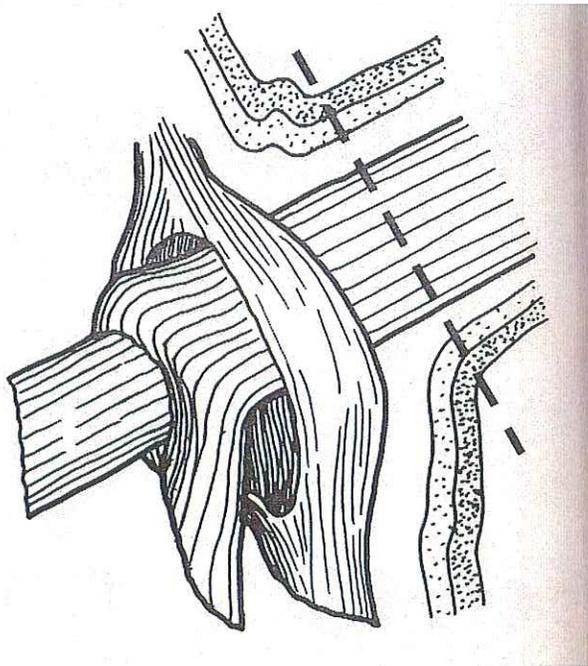


Figure 8.1 Proper pruning cut.

Structural Pruning of Young Trees

Structural pruning principles are used when pruning young trees or a tree that has not been pruned in many years. Properly trained young trees will develop into structurally strong trees that should require little corrective pruning as they mature.

Trees that will be large at maturity should have a study, tapered trunk, with well-spaced branches smaller in diameter than the trunk. Branches should be no more than $\frac{1}{2}$ the diameter of the trunk. If two branches develop from apical buds at the tip of the same stem, they will form co-dominant branches (Figure 8.4). Each co-dominant branch is a direct extension of the stem. It is best if one is removed when the tree is young.

Branches that have narrow angles of attachment and co-dominant branches may tend to break at the point of attachment if there is included bark (Figure 8.5). Included bark is bark that gets enclosed inside the crotch as the two branches develop. It weakens the branch attachment, making the tree more prone to storm damage. Such branches are preferably removed. The relative size of a branch in relation to the trunk is more important for strength of branch attachment than is the angle of attachment.

On large-growing trees, except whorl-branching conifers, branches that are more than $\frac{1}{3}$ the diameter the trunk should be well-spaced along the trunk (at least 18 inches apart) (Figure 8.6). Maintain one-half the foliage on branches arising in the lower $\frac{2}{3}$ of the tree. This helps to increase trunk taper, and more uniformly distributes weight and wind

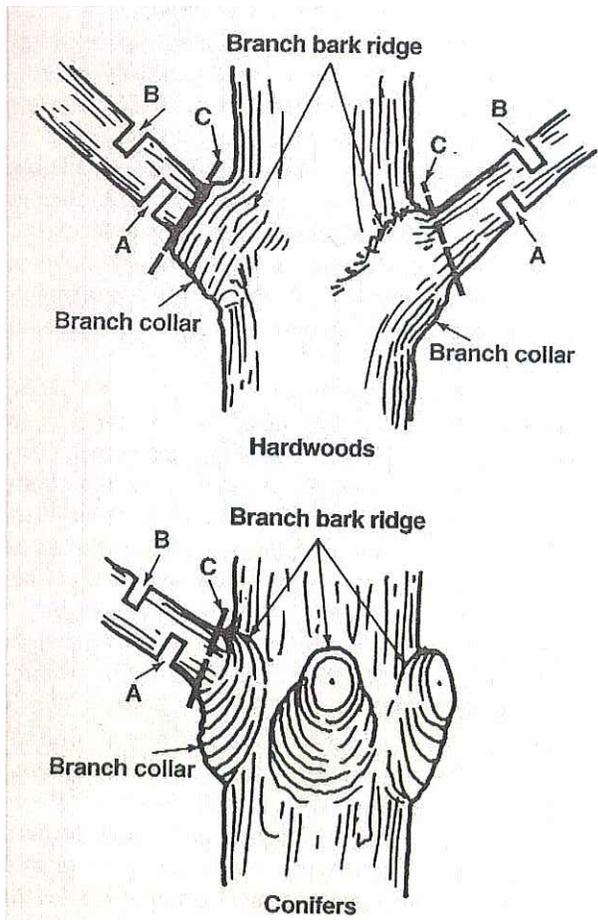


Figure 8.2., Pruning principles: the first cut (A) undercuts the limb. The second cut (B) removes the limb. The final cut (C) should be just outside the branch collar to remove the resultant stub.

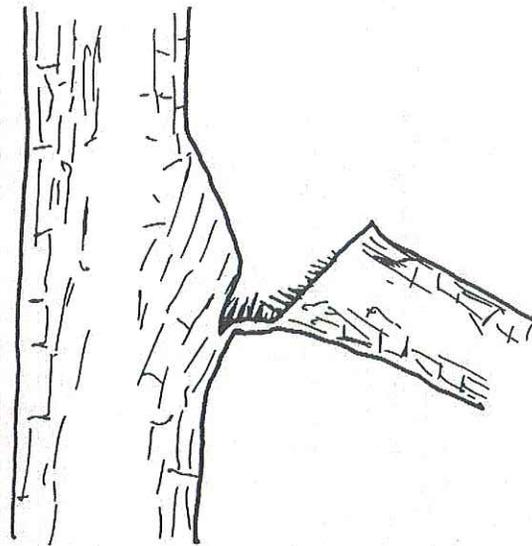


Figure 8.3. Improper pruning cut. If a heavy limb is not undercut, it may "peel" back, tearing bark and vascular tissues of the parent limb.

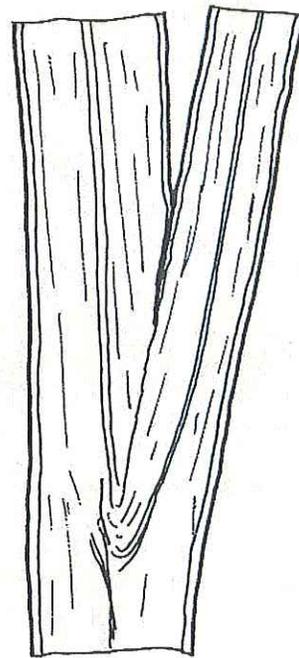


Figure 8.5. Included bark weakens branch attachment in tight crotches.

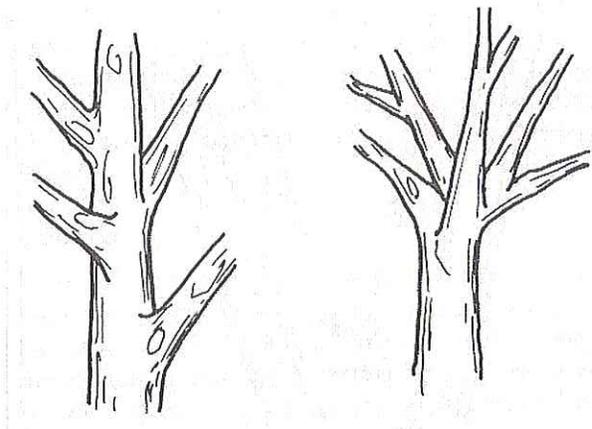


Figure 8.6. A tree that has been pruned for structure will have branches evenly spaced on the trunk, as illustrated by the tree on the left.

stress along the trunk. This rule of thumb also holds true for an individual limb. Leave lower and inside branches along the limb so that the limb can develop taper, and stress can be evenly distributed along it.

The height of the lowest scaffold branch will depend on the intended function of the tree (i.e., screen an unsightly view, provide a wind break, shade a patio, or be a street tree). Select main branches to give radial distribution. Discourage branches growing directly over another, unless spaded well above the lower branch.

Pruning Mature Trees

Various methods and techniques of pruning mature trees are used by arborists. These include deadwooding, thinning, crown reduction, crown restoration, and raising. The method employed will depend upon the condition and site of the tree and the wishes of the client.

Deadwooding is the removal of dead, weak, and dying branches from a tree to eliminate safety hazards. Routine pruning should remove the dead, diseased, crowded, weakly attached, low-vigor branches and water sprouts from a tree crown. Regular pruning should correct small growth problems before they have a chance to become large problems.

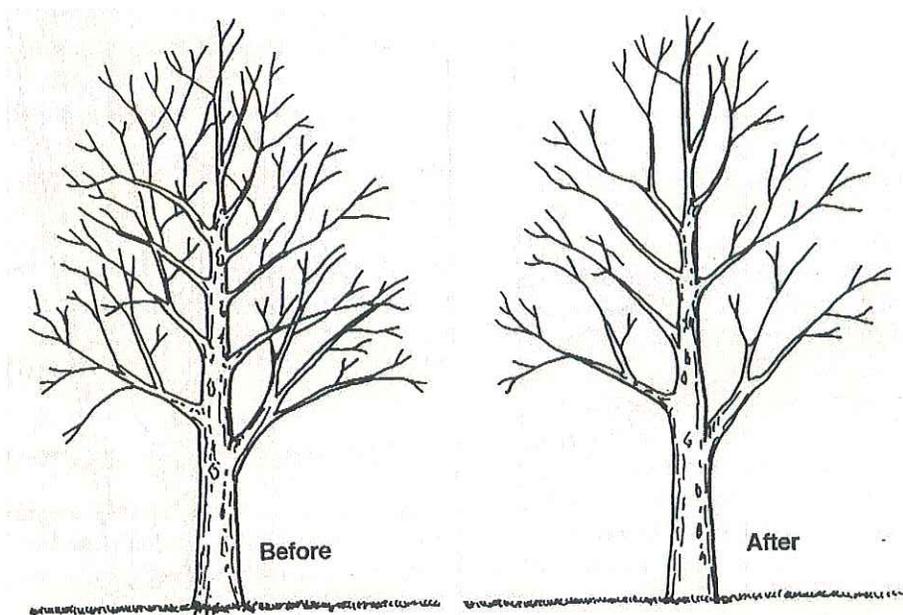


Figure 8.7. Thinning a tree removes unwanted branches, reduces weight, and allows light and air penetration.

Crown thinning includes crown cleaning as well as selective removal of branches to increase light penetration and air movement into the crown, and to reduce weight. Increased light and air stimulates and maintains interior foliage. A thinning cut removes a branch at its point of attachment. Thinning cuts cause little or no visible response in a tree, except that the growth on the branch is slowed by the removal of leaves. Thinning reduces the wind-sail effect of foliar clumps in the crown, and relieves the weight of heavy limbs. Thinning the crown can emphasize the structural beauty and retains the tree's natural shape (Figure 8.7).

When thinning laterals from a limb, an effort should be made to maintain well-spaced inner lateral branches to achieve even distribution of foliage along the branch. Caution must be taken not to create an effect known as liontailing, which is caused by removing all of the inner laterals and foliage. This displaces foliar weight to the ends of the branches and may result in sunburned bark tissue, watersprouts, weakened branch structure, and breakage.

Sometimes the crown of a tree must be reduced in height or spread such as for utility line clearance. Crown reduction is used to reduce the size of a tree (Figure 8.8). This is best accomplished by cutting limbs back to laterals that are at least 1/3 the size of the parent limb. This is also referred to as drop-crotch pruning (Figure 8.9). This method will help to maintain the structural integrity and natural form of the tree, and delay the time when it will need to be pruned again (Figure 8.10). Topping or heading back involves the cutting of limbs back to a stub, bud, or lateral branch not large enough to assume the terminal role (Figure 8.11). Severe heading causes decay and sprout production from the cut ends, resulting in a potentially hazardous situation once the sprouts become large and heavy (Figure 8.12). Topping or heading back is not a recommended pruning method in most situations (Figure 8.13).

If a tree has been topped previously and has sprouted vigorously, crown restoration can improve its structure and appearance. One to three sprouts on main branch stubs are selected to become permanent branches and to reform a more natural appearing crown. Selected vigorous sprouts may need to be thinned to a lateral to control length growth and ensure adequate attachment for a size of the sprout. Restoration usually requires several prunings over a number of years.

Trees in urban and landscape settings may need to have lower limbs removed (Figure 8.14). Crown raising or elevating removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas (Figure 8.15). Excessive removal of lower limbs should be avoided so that the development of trunk taper is not affected and structural stability is maintained.

Regardless of the pruning techniques used, avoid removing more than 1/3 of the foliage in one season. Excessive thinning or crown reduction can stress a tree because of the reduced photosynthetic capacity. In addition, thin-barked branches or trees may be subject to sunscald of bark tissues.

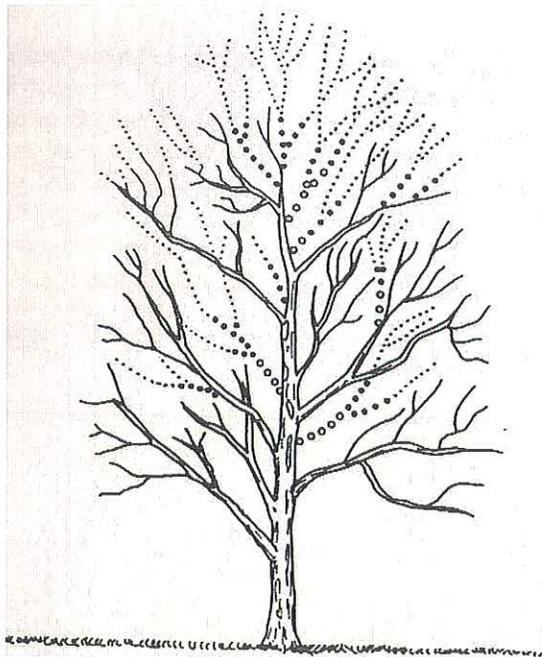


Figure 8.8. If the height of a tree must be reduced, all cuts should be made to strong laterals or to the parent limb. Do not cut limbs back to stubs.

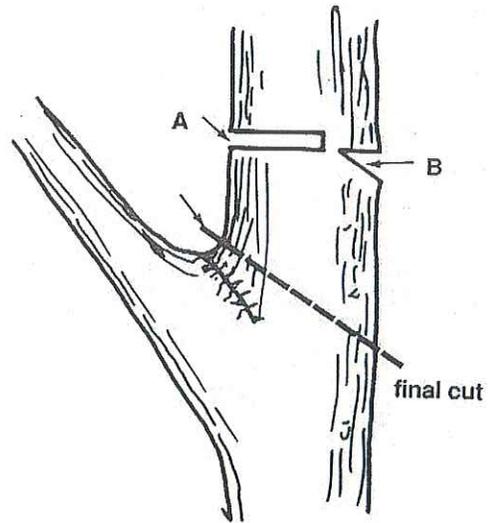


Figure 8.10. Drop crotch pruning cuts a limb back to a major lateral.

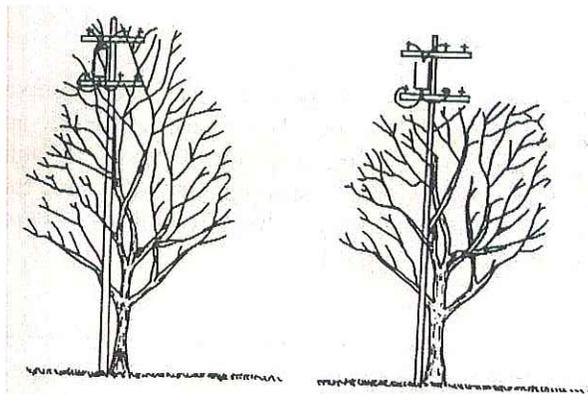


Figure 8.9. Drop crotch pruning

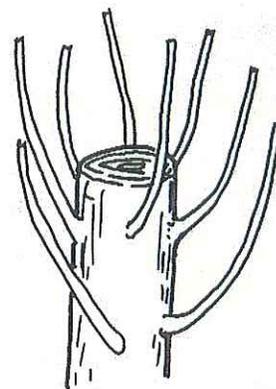


Figure 8.11. Watersprouts develop profusely following a heading cut.

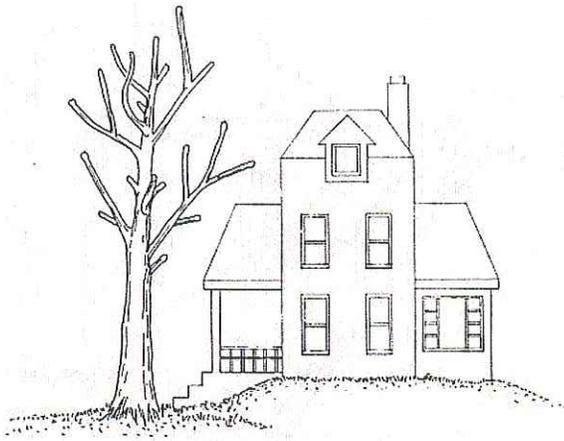


Figure 8.12. Trees that have been topped may become hazardous and unsightly.

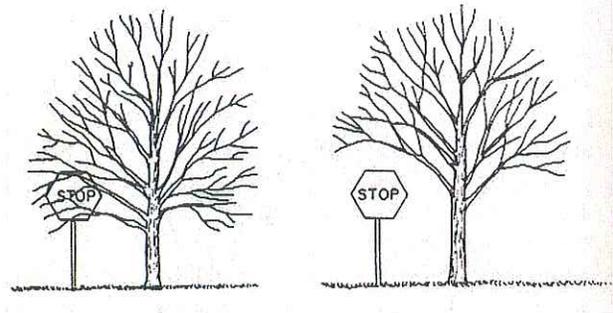
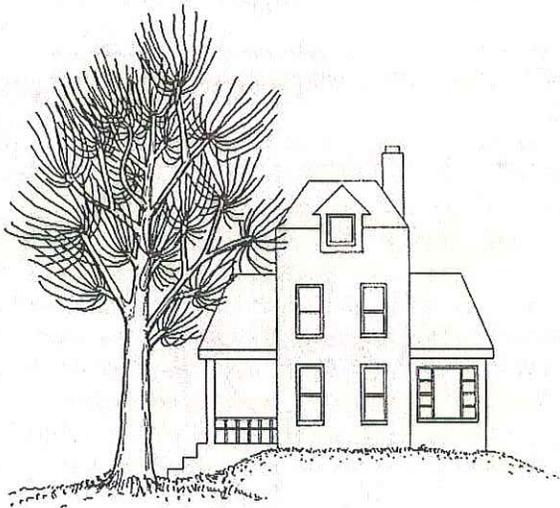


Figure 8.14. Crown raising.

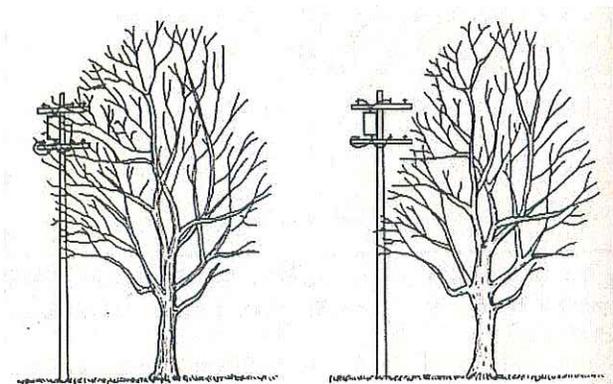


Figure 8.15. Side pruning.

Wound Dressings

Wound dressing was once thought to accelerate wound closure, protect against insects and disease, and reduce decay. However, research has shown that dressings do not reduce decay or prevent insect or disease penetration. Some studies have shown beneficial effects in specific cases in reducing borer attack and oak wilt infection. However, wound dressings are primarily used for cosmetic purposes, and only a light coating of a non-phytotoxic material is applied.

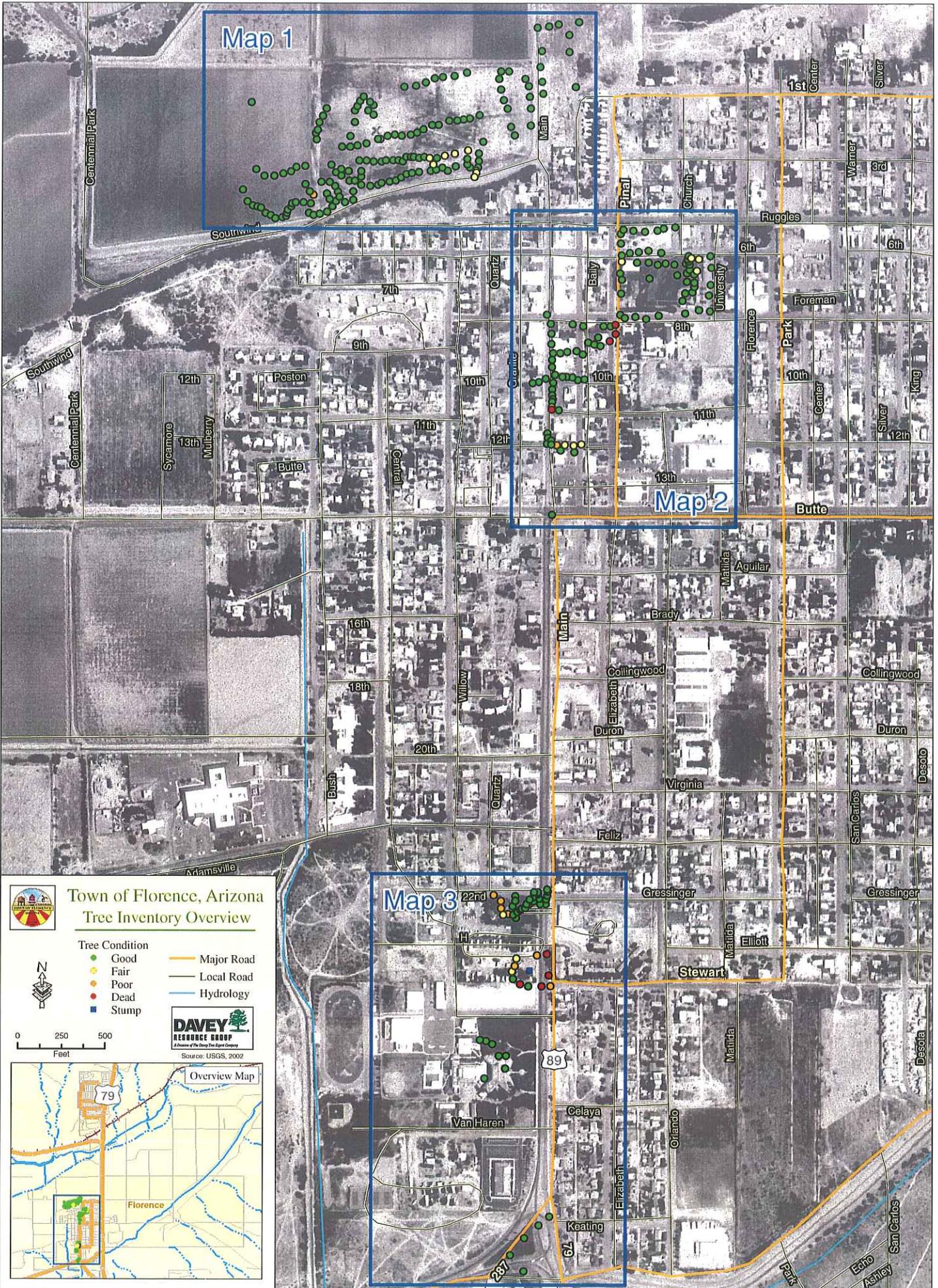
Plant Growth Regulators

Plant growth regulators are substances, usually effective in small quantities, which enhance or alter the growth and development processes of a plant. In most cases, these chemicals either increase or decrease normal growth, flowering, or fruiting of plants.

Utility arborists use growth regulators to control the growth of trees and other vegetation beneath utility lines. Growth inhibitors can be sprayed on the foliage, banded on the bark, soil applied, or injected into the tree. Anti-gibberellins, are growth regulators which counter the effects of the naturally occurring cell-elongation hormone, gibberellin. These chemicals can significantly reduce pruning expenses. There is a great deal of research being done to find ideal formulations, while minimizing phytotoxicity.

Another use of growth inhibitors is to reduce water sprout production on trees. Studies have shown that water sprout and sucker growth can be minimized with the use of growth regulators. The use of these chemicals has not gained widespread acceptance by arborists. They must be applied annually, and concern over the use of chemicals in the landscape may be a limiting factor.

Appendix B: Tree Inventory Maps



Map 1

Map 2

Map 3

Town of Florence, Arizona
Tree Inventory Overview

- Tree Condition
- Good
 - Fair
 - Poor
 - Dead
 - Stump

- Major Road
- Local Road
- Hydrology



0 250 500
Feet



Source: USGS, 2002



Centennial Park

Southwind

Centennial Park

Sycamore

Mulberry

12th

13th

Poston

Butte

12th

11th

7th

9th

10th

11th

12th

16th

18th

20th

22nd

23rd

24th

25th

26th

27th

28th

29th

30th

31st

32nd

33rd

34th

35th

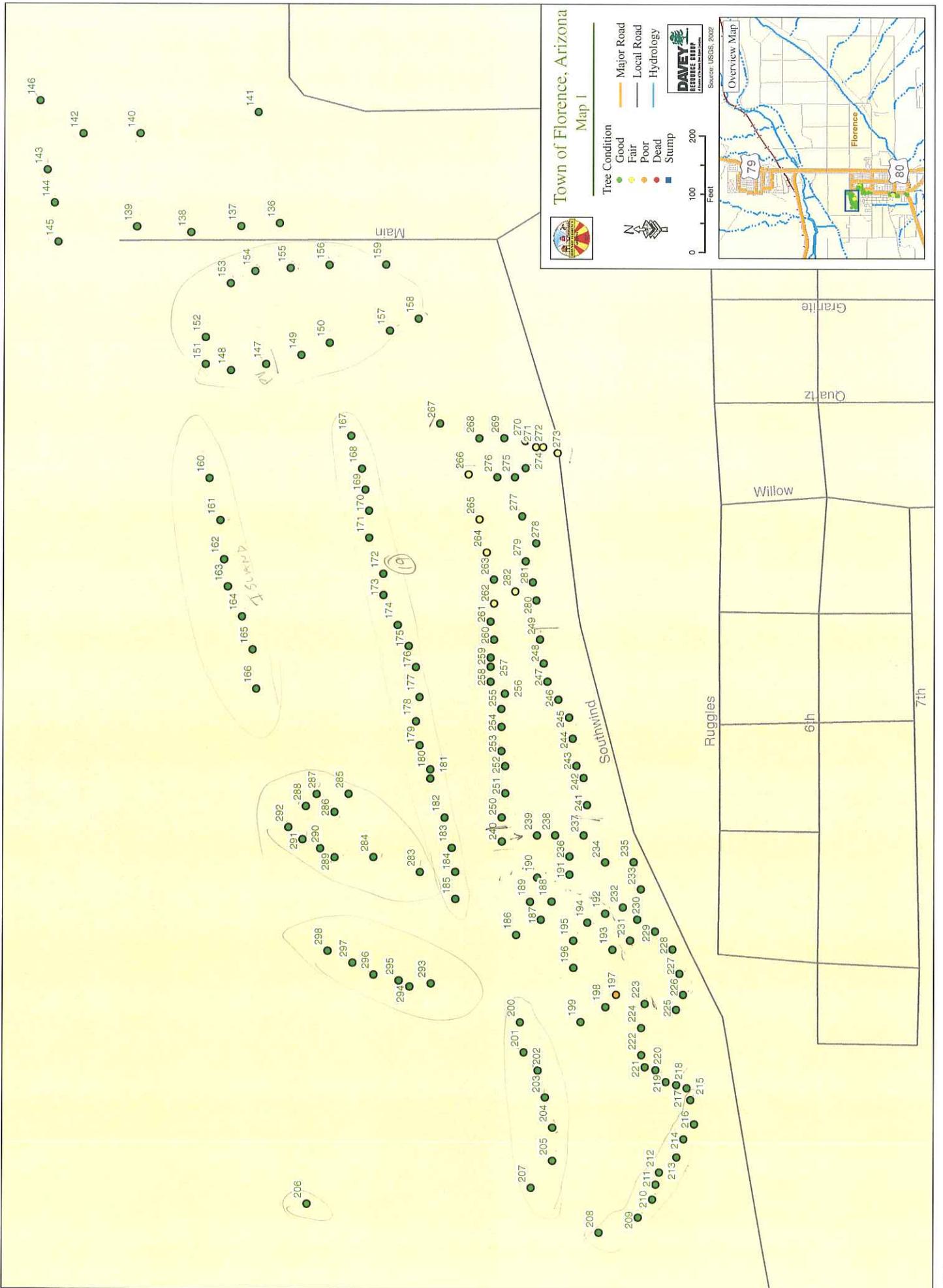
36th

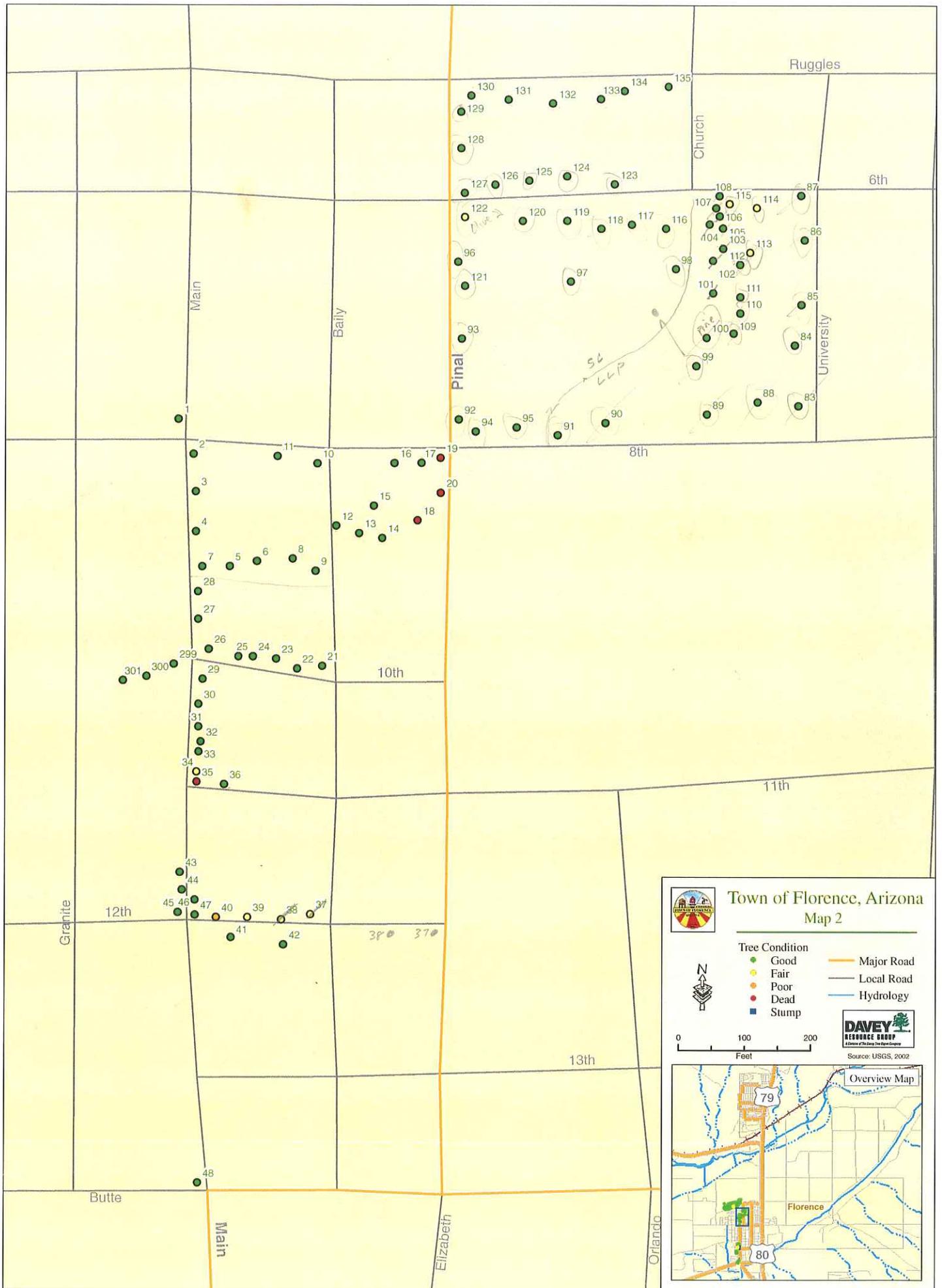
37th

Quartz

Central

Quartz





Ruggles

6th

Church

University

Pinal

Bailey

Main

8th

10th

11th

12th

Granite

Butte

Main

Elizabeth

Orlando

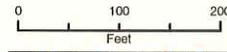
Town of Florence, Arizona
Map 2



Tree Condition

- Good
- Fair
- Poor
- Dead
- Stump

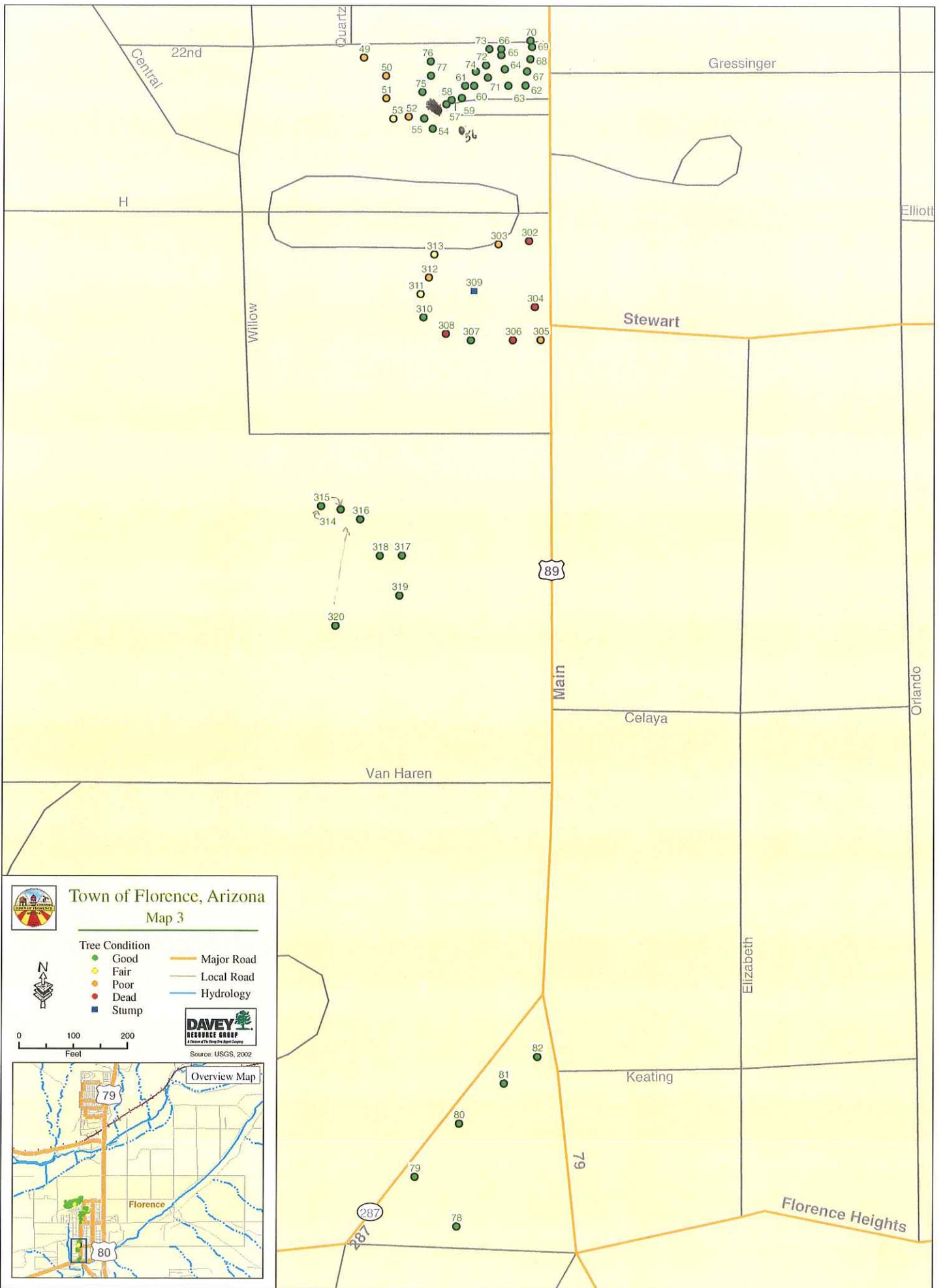
- Major Road
- Local Road
- Hydrology



Source: USGS, 2002

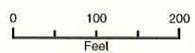


Overview Map



Town of Florence, Arizona
Map 3

- Tree Condition**
- Good
 - Fair
 - Poor
 - Dead
 - Stump
- Major Road
— Local Road
— Hydrology



Source: USGS, 2002

