Street Tree Inventory Report and Recommendations

City of Pearland, TX

October 2011

TEXAS FOREST SERVICE
The Texas A&M University System

Contents

Credits

The Texas Sample Community Tree Inventory (TXSCTI) system and report was developed by Texas Forest Service (TFS). It is adapted from the i-Tree Streets computer model developed by researchers at the Center for Urban Forest Research, a unit of the USDA Forest Service's Pacific Southwest Research Station. The statistical equations used to compute Standard Error values and percentages were specifically drawn from the i-Tree Streets model, as published in the latest user's manual. For more information about all the i-Tree tools, go to www.itreetools.org.

Recommendations provided are the judgment of the Texas Forest Service forester(s) listed below, based on the data collected in cooperation with community staff or volunteers. Questions or comments should be directed to:

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Executive Summary

In July 2011, Texas Forest Service (TFS) foresters and City of Pearland staff conducted a sample tree inventory of 190 randomly selected street segments covering 18.8 miles (5% of the total street miles maintained by the city).

Results include:

* Pearland has approximately 15,644 public trees that occupy 40% of the sites available for street and median trees.
* The population is dominated by oak (27%), crapemyrtle (21%) and pine (20%) species.
* Most trees are mid-sized with more than 50% of trees in the 6-10" diameter range and just 1% of trees larger than 20" diameter.
* More than 87% of street trees are in good condition; 79% of street trees require only routine care.
* An estimated 2,327 public trees and 3,267 private trees have limbs that encroach into clear zones above streets and sidewalks.
* Street trees in Pearland are valued at more than $24 million and generate environmental and other benefits worth almost $630,000 each year.

Recommendations include:

* Begin a program of pruning to train and shape young trees.
* Favor trees other than live oak and crapemyrtle in street tree planting projects.
* Develop a systematic program to prune for safety clearance over roads, sidewalks and traffic signals.
* Develop an annual work plan for tree maintenance and planting.
* Continue to hold an annual Arbor Day celebration and involve local groups.

City Description

The City of Pearland lies 18 miles south of downtown Houston, Texas. It is the largest city in Brazoria County, covering 45.6 square miles with small portions of its city limits extending into Fort Bend and Harris counties. Pearland is located in the Western Gulf Coastal Plain ecoregion, which is characterized by low elevation grasslands and wooded riparian areas along bayous, streams and rivers. The city was established in 1893 and derived its name from an abundance of pear trees in the community.

Pearland originally was promoted as an "agricultural Eden" but the Great Storm of 1900 caused massive destruction and slowed the city's growth for a time. Oil was discovered nearby in the 1930s but the population remained below 350. By the mid-1960s the town had 1,497 inhabitants and 41 businesses. More recently, Pearland – within commuting distance to Houston – has become one of the fastest growing communities in the state, increasing in population from 18,697 in 1990 to 37,640 in 2000 to 91,252 in 2010 (U.S. Census). City planners forecast the population to exceed 180,000 by the year 2030.

Pearland's vision statement calls for the city "to be identified as one of the most livable places in the United States in 2020." Additionally, one of Pearland's stated objectives within its Parks Master Plan is to "provide for the preservation and conservation of open space including wetlands, floodplains, streams and water bodies, woodlands, and natural areas."

Current Tree Management

Tree management in Pearland is guided by horticulturist and certified arborist, John Walters, within the Parks and Recreation Department (PARD). His duties include planting and maintaining park and street trees, as well as enforcing the tree protection and planting requirements of the city's Tree and Vegetation Ordinance. Several master planned communities are located within the city limits of Pearland and these have active landscape programs with crews that maintain public trees. Deed restrictions in some neighborhoods also require the approval of the homeowners association before removing certain trees.

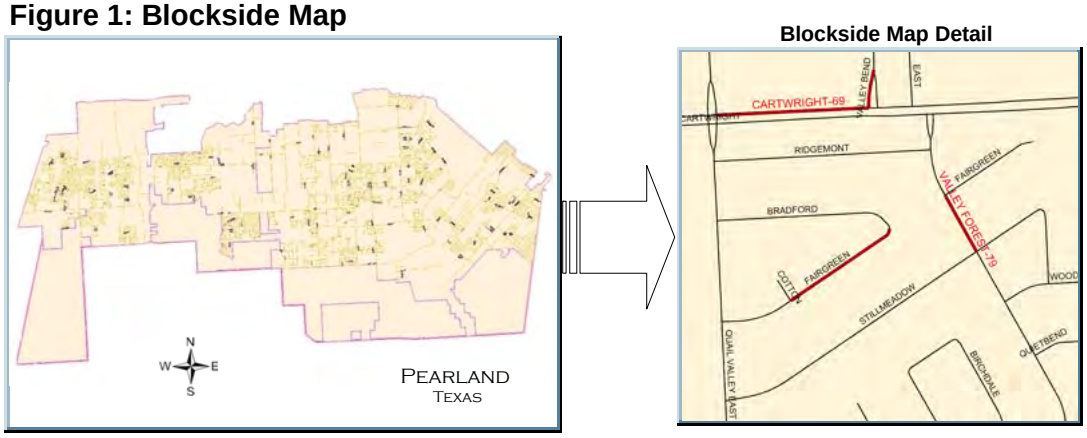
PARD's annual budget for tree work is allocated mostly to staff, but a small amount (approximately $15,000) is earmarked for contract pruning work. Tree planting is accomplished through city-sponsored capital improvement projects (CIP), with additional financial support from Keep Pearland Beautiful for smaller projects. In 2010, 451 trees were planted in city medians and parks. Wood waste disposal is performed through a contract and the processed mulch and compost is made available for purchase by the public. Safety and technical training for city staff is periodically provided by the TFS regional urban forester or through training sessions sponsored by the Houston Area Urban Forestry Council (HAUFC).

In 2009, Pearland received its first Tree City USA award and in 2011 hosted the State Arbor Day ceremony. Keep Pearland Beautiful is a key partner in planting projects and Arbor Day activities and has helped develop a small tree nursery that grows trees and shrubs for city planting projects and various ceremonial events.

Inventory Methods

The Texas Sample Community Tree Inventory (TXSCTI) system is designed to provide city staff and community leaders with basic information about the street tree resource. TFS foresters identify and survey a 5-15% sample of street segments – or "blocksides" – (see Figure 1 below) and collect data on the trees they find there. This sample is not a substitute for a complete inventory of street trees, but instead is designed to help foresters make basic short- and long-term recommendations for managing this important community asset.

Figure 1: Blockside Map



Field data collection is limited to relatively few key measurements (see Appendix A for data collection form and definitions). Trees located within the public right-of-way (ROW) on both sides of a randomly selected blockside segment, as well as those within a center median, are evaluated for species, trunk diameter, general condition, maintenance needs and safety clearance. Private trees outside the ROW are evaluated solely for safety clearance. Blockside segments also are surveyed for available planting spaces, within the ROW and median, as well as within 30 feet of the roadway on private property since private trees in this zone also provide public benefits. All estimates provided in this report represent public ROW and median trees combined, unless specifically identified otherwise.

The sampled trees provide the basis for statistical estimates for the entire street tree population. In general, sample sizes that produce a Standard Error (SE) value of 20% or less of the total tree estimate are considered sufficient for making basic judgments about the state of the street tree resource. Streets with center medians are included in the survey with the length of these street segments increased as if the median were divided between the two sides of the street. Table 1 details the sampling results for this survey.

Table 1: Street Tree Sampling Results

Total Miles (# blocksides):	373.80	(4605)
Miles Sampled (# blocksides):	18.80	(190)
Sample Size:	5.0%	(4.1%)
Estimated Total Public Trees:	15,644	
Standard Error (SE):	+/- 2,912	
Standard Error Percent:	18.6%	

The report findings are divided into three sections: Street Tree Structure, Street Tree Care and Street Tree Values. TFS foresters have provided professional insight into the data results, followed by a set of recommendations based on an understanding of the city's current program and the state of the street tree resource.

Street Tree Structure

The pattern of trees found in a community can be referred to as its structure. This includes the different tree species and their sizes, as well as the overall number of trees and how they fill the available space along city streets, which is what urban foresters call stocking. These key measures will guide the recommendations at the end of the report.

Stocking

Every city has a designated amount of street miles to maintain. A model residential street has trees planted along both sides of the ROW, often between the curb and sidewalk. Larger collector streets and boulevards also may have medians that are wide enough to support street trees. If all planting spaces are filled with the largest trees possible for the available growing space (termed "full stocking"), a typical U.S. city will have about 105 ROW trees per mile. This benchmark is equivalent to one tree every 50 feet, but takes into account visibility triangles at corners and lost planting spaces due to intersections, driveways and other public infrastructure. Median spaces provide additional planting opportunities, as do spaces on adjacent private property that can shade public sidewalks and ROWs. The estimates here did not take into account underground utility conflicts that would lower the potential number of planting sites.

Table 2 shows the current estimate of street trees in the community, as well as planting site criteria and opportunities as found in the sample inventory.

Table 2: Street Tree Stocking

Estimated No. ROW Trees:	12,902
Estimated No. Median Trees:	+ 2,742
Estimated Total No. Street Trees:	15,644
Total Street Miles:	373.8
Estimated Stocking (trees/mile):	41.85
% Stocking:	40%
Median/ROW Planting Spaces:	6,620
Private Yard Planting Spaces:	+ 11,450
Total Planting Opportunities:	18,070

Planting Site Criteria

Tree Size: Medium or large tree to be planted, if room; only small trees planted under powerlines.

Location: Within public ROW and/or within 30' of ROW edge in private front yard. Tree lawn minimum 4' width.

Distances: Overhead - 15'
Hydrant, utility pole, street light - 10'
Street intersection - 25'
Driveway - 5'
Other trees - 20-50'

Key findings:

Pearland has an estimated street tree stocking level of 40%, which leaves ample opportunities for increasing street tree cover. To reach full stocking, the city would need to plant new trees in all of the estimated 6,600 planting spaces available along medians and ROWs. This would require planting more than 660 trees annually over the next ten years and replacing all trees removed during that period.

Beyond the city-owned ROW space, private homeowners could plant another 11,000 trees in their front yards within 30 feet of the curb. Since these owners provide tree maintenance, either individually or through their homeowner associations, Pearland can realize the added benefits of trees over streets and sidewalks without the associated increase in management costs.

However, filling many of the planting sites on ROWs and medians will be challenging. Planting spaces less than four feet wide between the curb and sidewalk can prevent the planting of shade trees along new streets. Utility easements also may occupy the spaces normally reserved for street trees. The design of streetscapes in Pearland will ultimately determine the number of street trees that can be planted.

Species

As a rule, urban foresters recommend having no more than 10% of the street tree population made up of any one species, and no more than 20% made up of any one tree genus (i.e. the oaks or elms). This can prevent the catastrophic loss of trees during an outbreak of insects or disease – like Dutch Elm disease in the Eastern United States or Emerald Ash Borer in the Upper Midwest. Species diversity is one sign of a healthy tree resource.

Figures 2 and 3 show the most common species and genera, respectively, found in the sample inventory. The top ten species or genera are shown (could be more if categories tie for tenth place), plus a category combining the remaining species or genera. A complete list of species encountered during the inventory is listed in Appendix B.

Figure 2: "Top Ten" Species

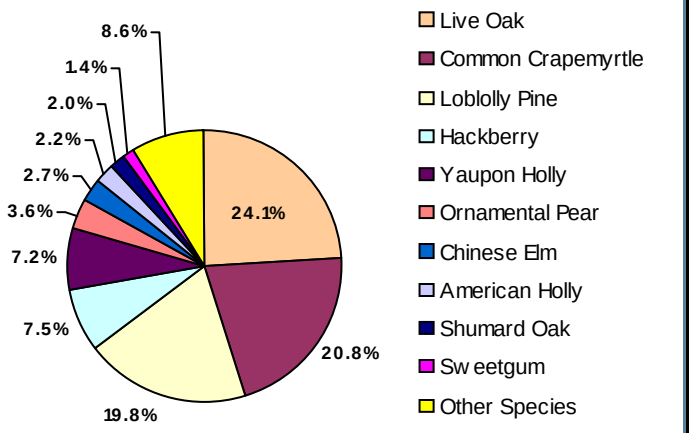
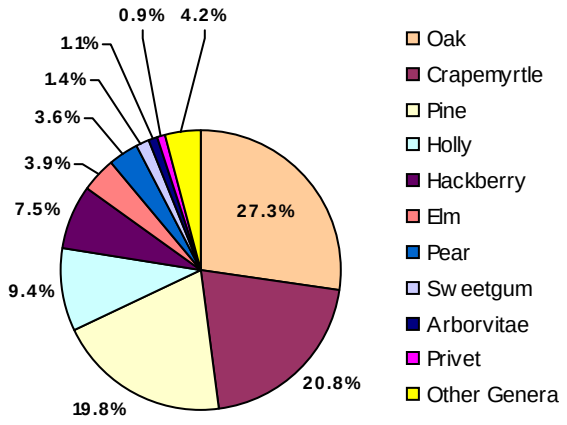


Figure 3: "Top Ten" Genera



Key findings:

The population of street trees in Pearland is dominated by just a few species: live oak (24%), crapemyrtle (21%) and loblolly pine (20%) combine for almost two-thirds of ROW and median trees. At the genus level, oaks (27%) and crapemyrtles (21%) account for roughly half of all trees. Crapemyrtle, yaupon (7%) and ornamental pear (4%) represent three small-statured species that have been extensively planted for ornamental purposes.

Because oaks, pines and crapemyrtles are so prevalent today, it may be difficult to achieve a model street tree distribution in Pearland. More importantly, the greatest risks are posed to pine trees, which are vulnerable to outbreaks of bark beetles (Southern Pine Beetle, Ips beetles, etc.) and strong wind events. It would be prudent to have a plan in place to inspect and remove dying trees from public streets to quickly minimize the risk of falling debris and the risk of insect or disease infestations spreading to adjacent trees.

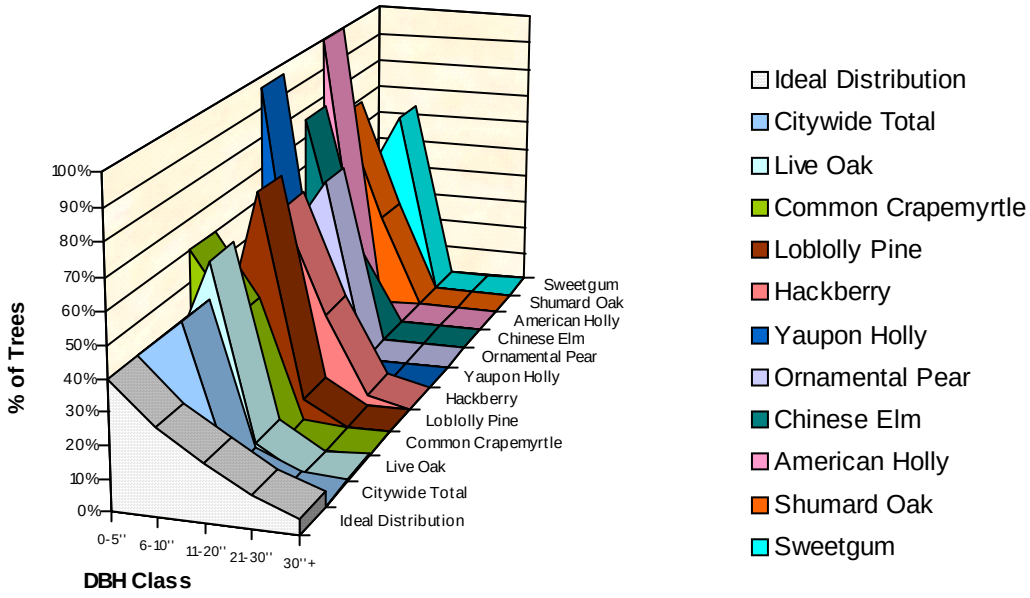
For the ornamental trees, the risk related to having so many crapemyrtles is not from insects or disease (since most modern horticultural varieties are resistant to powdery mildew), but from high maintenance costs. Crapemyrtles can be costly to maintain, especially if annual pruning is performed, yet they rarely reach sizes that deliver significant environmental benefits. Planting a wider variety of ornamental trees can also lengthen the period of showy blooms in the community.

Size

Tree diameter – also called diameter at breast height (DBH) – is measured on the trunk, 4.5 feet off the ground. This sample inventory assigned each tree to one of nine size classes as detailed in Appendix B (palms and yuccas are assigned to a class by feet of clear trunk height). The 10 most prevalent species are displayed as a graph in Figure 4 (below).

Tree size is generally a good indicator of age, since large trees are usually older than small trees. But species composition can also influence the size class distribution because small-statured species will never grow into the larger classes. Taking into account mortality rates, which are higher for trees when they are young, a balanced size distribution for a species will have more trees in the smaller size classes and fewer in the larger size classes. This report compares the top 10 species to an ideal distribution of 40% young trees (0-5" DBH), 27% maturing trees (6-10" DBH), 18% mature trees (11-20" DBH) and 15% old trees (>20" DBH).

Figure 4: DBH Distribution of Top Ten Species, in Order of Abundance



Key findings:

The size distribution of street trees reflects Pearland's recent pattern of growth, which generated distinct waves of tree planting over the past 30 years as new homes and businesses were built. With few trees in the native landscape, almost all street trees are planted specimens and several of the most common trees are non-native species (Figure 4). The distribution also reflects some of the species choices for streetscapes, since small-statured species like crapemyrtle, ornamental pear and yaupon rarely grow into a larger class.

Some of the distributions for individual species offer additional insight (see Appendix B for detail). In particular, hackberry represents a tree species likely present when roads were built into the native landscape. They survived the construction and are now some of the larger trees found in our survey. But damage to trunk or roots during construction can start the decay process that leads to structural failure many years later. Trees in the larger size classes should be inspected periodically for structural soundness as part of the overall management program.

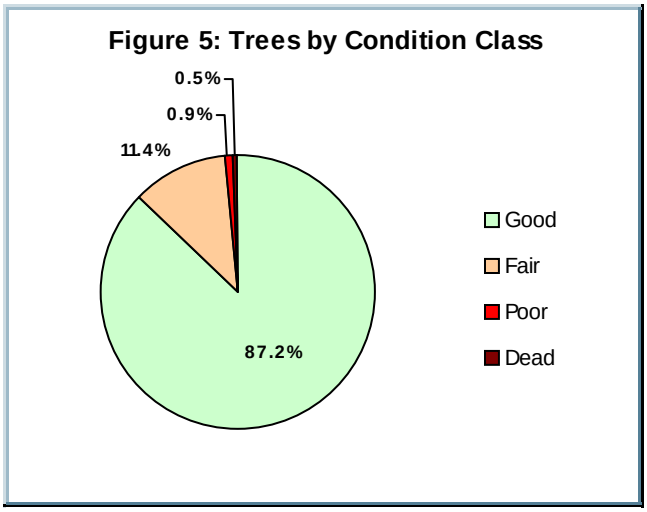
Street Tree Care

The care and maintenance practices for street trees – or lack thereof – will determine the condition of the resource as well as its future needs. This sample inventory evaluated trees for their overall condition, maintenance needs and safety clearance.

Condition

Sampled trees were briefly observed and assigned to one of four condition classes: good, fair, poor or dead (see Appendix A for condition class descriptions). This evaluation was designed to capture an overall assessment of the tree including its health and structural soundness. It did not rate each individual part of the tree such as leaves, twigs, branches, trunk and roots.

Figure 5 shows the distribution of street trees by condition class, as found in the sample survey.



Key findings:

The overwhelming majority of street trees in Pearland are well-cared-for with more than 87% in good condition. If proper maintenance continues, these trees can remain in good health and produce increasing economic and environmental benefits for years to come.

But 11% of street trees are only in fair condition. These are trees that usually can be restored to full health with appropriate treatment, but much depends on the reason for the classification. Trees in this category may be larger specimens that have damage from previous storm events or internal decay due to advanced age. Or, trees rated 'fair' could be new plantings that were planted incorrectly or are suffering from the year's drought conditions.

A very small number of trees were rated poor (<1%) in the survey. One key reason for rating a tree as 'poor' during our survey would be evidence of past topping, a common but misguided practice of cutting off main limbs. Some of these trees will never recover from such treatment, developing decay that forces their removal at some point. Removal cost is almost always higher than the cost of proper maintenance.

Maintenance

Tree maintenance is the primary responsibility of the street tree manager. A prudent manager will schedule the removal or repair of trees that pose a risk to the public, as well as improve tree health and reduce future maintenance costs. This sample inventory evaluated ROW and median trees and assigned each to a maintenance category as shown in Table 3 (below).

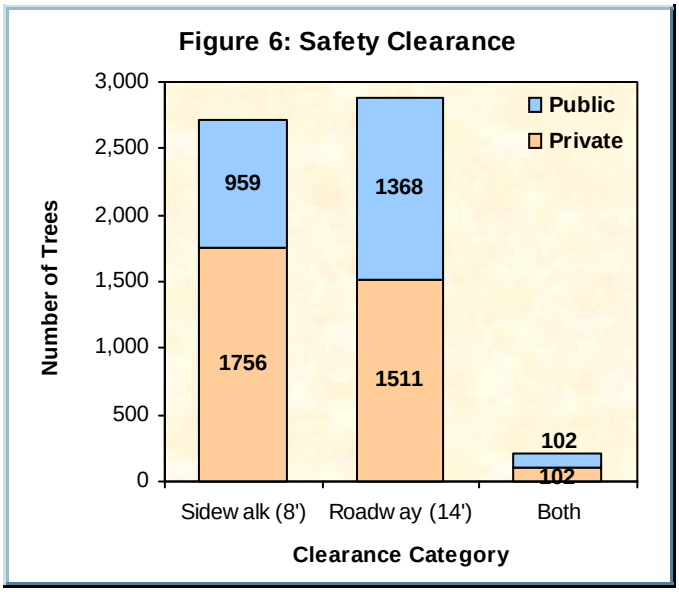
Table 3: Maintenance Needs

Treatment	Description	Estimate	Percent
Prune-Immediate	Dangerous broken branches and/or large deadwood. Presents safety risk to persons or property. Pruning should be accomplished as soon as resources are available.	20	0.1%
Prune-High Priority	Broken branches or deadwood, but no apparent immediate safety risk to persons or property. Prune as soon as resources are available.	0	0.0%
Prune-Routine	Routine, ongoing pruning should be scheduled on a cycle of five to seven years to remove dead, dying or diseased branches.	12,305	78.7%
Prune-Training	Recent plantings require pruning that develops a strong central leader and scaffold limbs, while eliminating trunk sprouts and dead, crossing, diseased or weak branches.	3,220	20.6%
Remove-Immediate	Trees should be removed ASAP because their condition and proximity to active-use areas pose an apparent risk to persons or property.	0	0.0%
Remove	Low priority removals should be scheduled when resources are available and after high-priority removals. Trees are generally located away from facilities and areas of use.	99	0.6%

Clearance

One important aspect of a tree maintenance program is to create safe clear zones over streets and sidewalks and to ensure the visibility of traffic signs and signals for emergency vehicles and the public. Even though a tree may be located on adjacent private property, it is the city's responsibility to ensure that necessary pruning is performed – either by the owner or the city. Figure 6 shows the estimated number of trees that require pruning to meet the appropriate distance standard.

Figure 6: Safety Clearance



Key findings:

Because Pearland has many small trees along its streets, training pruning is required for more than 3,200 trees (21%). This type of pruning shapes and directs the growth of young trees, helps reduce future maintenance costs and allows each tree to reach its potential. Training pruning is the single best maintenance investment a city can make.

Our survey estimates a total of just 20 street trees that require immediate pruning. Trees that generated these sample results were reported to city officials after they were discovered and should have been treated already. Fewer than 100 trees are estimated to require removal as time and resources allow.

Safety clearance over sidewalks (8') and streets (14') is one area of concern. An estimated 2,300 public trees and 3,300 private trees have limbs that encroach into the safety zones above streets and sidewalks, and an additional 204 trees obstruct both. Safety clearance work provides an excellent reason to develop a routine maintenance schedule for all street trees.

Street Tree Values

Developing a management program for street trees undoubtedly carries the burden of cost. But these trees also deliver valuable returns to a community and in recent years many of these values have been quantified. Street trees stabilize neighborhoods and add value to adjacent real estate, thus improving the property tax base. They reduce air and water pollution, increase the energy efficiency of nearby buildings, sequester carbon and can even lower medical costs. The aesthetic benefits of street trees are harder to quantify, but they are just as important if you ask most citizens. New research aims to quantify the health benefits for pedestrians from direct shading by street trees, the economic benefits from increased shopping activity in business districts with trees and reduced street repair costs. In fact, public trees are the only portion of a city's infrastructure that can increase in value over time because healthy trees grow each year and increase the benefits they provide. Investing in a tree maintenance program can actually deliver a positive return to a city when the full benefits of trees are considered.

Tree Replacement Value

One accepted method for quantifying the value of trees was developed by the Council of Tree and Landscape Appraisers, published as the *Guide for Plant Appraisal–9th Edition (2000).* This method combines tree ratings in four categories (species, condition, size and location) to calculate the cost of replacing a given tree in the event it is damaged or destroyed. The location rating is an average of three factors: site, contribution and placement. This sample inventory used a conservative location rating of 70% and recorded DBH class values and condition ratings, as well as published species ratings and regional replacement costs (Texas Supplement, Third Approximation, 2011) to arrive at the estimated street tree value shown in Table 4. A complete list of replacement values by species is shown in Appendix C.

Table 4: Tree Replacement Values

Estimated No. Trees:	15,644
Estimated Total Value:	$24,392,243
Average Tree Value:	$1,559 ea.

Key findings:

Street trees in Pearland have a replacement value totalling more than $24 million, an average of $1,559 per tree. Considering the number of healthy trees that will continue to grow over time, city leaders can expect increasing value from street trees for many years to come.

Appendix C illustrates the value of large trees. Even a tree with a low species rating such as black willow has a high average value ($11,073/tree) because the average DBH is 25". Conversely, yaupon holly represents 7.2% of the total street tree population, but because their average size is so small (3.3" DBH) they represent just 1.1% of total value ($243/tree). Unfortunately, this species simply won't grow much beyond this average DBH, meaning its value contribution won't increase much either.

And it's no surprise that live oak is the most valuable species in Pearland, since it also is the most common. With trunk diameters averaging a modest 8.2" DBH, the value of these trees will continue to increase for many years as they grow to maturity.

Environmental Values

Trees are more than just landscape specimens; they are living organisms that grow new tissue each year. In a healthy tree, this organic process produces an increasing number of leaves. More leaves means more photosynthesis, more leaf area to intercept rainfall, more oxygen production and carbon uptake, cleaner air and a larger tree to shade nearby buildings.

Recently, new methods for calculating these benefits have become available. *i-Tree* is a software suite offered by the USDA Forest Service that can calculate several key benefits of trees. In particular, the *i-Tree Streets* tool is designed to quantify the value of environmental services that street trees provide. It uses tree growth curves and computer models that consider regional climate, building characteristics, air pollutant concentrations and median housing prices to produce a general accounting of street tree benefits. Table 5 summarizes the monetary value of five key environmental and social benefits.

As described in the *i-Tree Streets* manual, energy benefits are derived from the reduced cost for natural gas and electricity used for home heating and air conditioning. Stormwater is the value of runoff intercepted by trees as rainfall. Air quality benefits include pollutant uptake by leaves and lower emissions from power plants from reduced energy use. Carbon dioxide (CO2) values reflect the reduction in atmospheric carbon due to the woody growth of trees, plus reduced carbon emissions from power plants from reduced energy use. Aesthetic and other benefits reflect the increase in property value from the tangible and intangible benefits of trees.

Table 5: Annual Environmental Benefits

Energy:	$82,582
Stormwater:	$88,389
Air Quality:	$8,444
CO2:	$17,694
Aesthetics/Other:	$432,808
Estimated Total Benefits:	$629,916
Average Tree Benefits:	$40.27 per year

Key findings:

In addition to the $24 million replacement value for street trees, these public assets provide approximately $630,000 annually in economic, environmental and social benefits to the residents of Pearland. That's an average of $40.27 per tree, per year. When you consider the current city maintenance budget for street trees, you can see that this portion of the public infrastructure is providing a high benefit-to-cost ratio to the city. Also, the fact that Pearland's street trees are relatively young means that the benefits will continue to grow exponentially as these trees increase in size.

The largest single value ($432,808) is generated by the increase in property values, followed by the benefit of reduced stormwater detention ($88,389). The energy savings ($82,582) will depend on setback distances to homes and businesses as well as the overall amount of tree cover in the area. The neighborhood cooling effect of tree cover depends on a critical mass of trees, both along the ROW and on adjacent private property.

Pearland’s street trees also generate more than $8,000 worth of air pollution abatement and the annual growth of street trees removes CO2 from the air, a service worth $17,694.

Recommendations

The purpose of this report is to provide city leaders with a snapshot of the current structure, maintenance needs and replacement value of the street tree population. Below are the short- and long-term recommendations from Texas Forest Service that the city can use to craft a plan for managing street trees into the future.

Short-Term (1-3 years)

Planting: develop a strategy to plant new trees annually

Pearland has a modest stocking rate of 40%. With as many as 6,600 public tree planting sites available, some sort of formal streetscape program should be implemented and budgeted to plant trees in appropriate locations along streets and medians. Even a small program will ensure that some new trees are added each year to replace those that die and must be removed.

One successful model is "NeighborWoods." Through this program, the city forester joins forces with civic groups, homeowners associations and businesses to select planting sites and then purchase and distribute trees for citizens or volunteers to plant in the ROW. Establishment care then becomes the responsibility of the adjacent homeowner. Another option would be to focus on the 11,000 planting sites on private property, within 30 feet of the curb.

Species to consider adding along streets include overcup oak, bur oak, swamp chestnut oak, baldcypress, American elm, cedar elm, Mexican sycamore, anacua, red maple, magnolia, Texas redbud, Mexican plum, possumhaw and Texas persimmon.

Maintenance: lower the risk to the public from trees

To manage the risk from street trees, the first priority should be to locate and remove trees that pose immediate risk to persons or property. One effective strategy may be to educate appropriate city workers (e.g., public works, fire or police) on how to identify and report a risky tree.

From our survey, as many as 15% of all public street trees require pruning for safety clearance over roads and sidewalks. Therefore, the second priority should be to develop a systematic plan to address clearance pruning within neighborhoods.

Use a contract or in-house workforce for your routine tree maintenance program. Tree crews would need to visit approximately 1,500 trees per year over a five- to seven-year cycle to conduct routine safety pruning on existing trees larger than 5" DBH. This systematic approach will keep these trees healthy and allow city staff to notify the owners of the estimated 3,300 trees on private property that also have clearance problems.

The resources of city staff can be best used by concentrating on training pruning for the 3,200 young trees (5" or less DBH) along streets. This investment will prevent poor branching and greatly reduce future maintenance costs. Training pruning requires few specialized tools and can be easily taught to staff members or volunteers.

All tree work should conform to the latest ANSI A-300 (Tree, Shrub and Woody Plant Maintenance) and ANSI Z-133 (Safety) standards, as well as the latest Tree Pruning Guidelines from the International Society of Arboriculture (ISA) or the Tree Care Industry Association (TCIA). All work should be directed by ISA certified arborists.

Short-Term Recommendations, cont'd

Policy: review ordinances, standards and training

Review local tree ordinances to clarify the role of city departments in caring for street trees. A public tree care ordinance is one of the four required standards for achieving Tree City USA status. The ordinance also can set standards for locating new plantings and define the role individuals, groups and businesses will play when planting trees in the public ROW.

Develop a system for tree maintenance and planting and keep track of your progress. Such annual accomplishment reports can be used to support your Tree City USA recertification application each year. A complete management plan covering the next three to five years would help guide work into the future and help set budget levels to accomplish your goals.

Conduct a basic tree care workshop to train city personnel from all applicable departments on proper tree maintenance practices. The TFS regional urban forester can help schedule training classes, workshops and other educational opportunities.

Community Support: get the public involved

Use the Tree City USA framework to build support for your tree management program. Continue to work with Keep Pearland Beautiful to sponsor a community Arbor Day celebration and involve citizens in planning the event. Arbor Day also can provide opportunities to involve other community organizations and local schools. These groups can be great partners that support and advocate for tree issues in the community. Your TFS regional urban forester can support a recognition ceremony at city council meetings or on Arbor Day.

Look to the private sector for additional support. Through your non-profit partners, many local businesses often are willing to donate to activities with a strong public benefit such as planting and caring for trees. In this era of increasing awareness on environmental issues, many companies are looking for opportunities to invest in local communities.

Long-Term Recommendations

Develop a Street Tree Master Plan to guide annual work plans and provide long-range budget forecasting. This can be an important tool in communicating to city leaders the need for an ongoing maintenance budget. This plan will identify street tree priorities, goals and objectives, and it can help integrate street trees into city infrastructure. As part of the plan, consider a "green infrastructure" fund (1-2%) to pay for new trees on all city capital improvement projects. Other possibilities for diversifying program funding include stormwater or transportation fees, utility bill "check off" programs or even energy efficiency grants provided by your local electric utility.

Conduct a complete inventory of street trees, which will allow for more efficient management and maintenance of this important part of the community's urban forest. Advances in commercially available software now allow tree inventory data to feed directly into a municipal work order system, vastly improving efficiency and customer service while allowing quick updates to the tree data once work is performed. A complete inventory then can be used to conduct a more thorough cost-benefit analysis of the city's trees using the the i-Tree Streets tool.

Appendix A–Part 1: Sample Blockside Data Sheet

Blockside #:_____ **ROW Width (ft.):** _____ **Date:** _____ **Crew:** _____

Street: _____ **From:** _____ **To:** _____

Tree #	Median/ Private	Species Code	DBH Class					Condition Rating				Maintenance				Priority					OU
			0-5	6-10	11-20	21-30	31+	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU
	M P		1	2	3	4	5	G	F	P	D	RC	SC	TP	PST	PI	PH	PR	RI	RR	OU

Notes/Comments

Address/Intersection

Planting Sites

ROW: _____

Private: _____

<30' from ROW

Appendix A–Part 2: Data Sheet Definitions

Pearland Tree Inventory Information:

Segment Number: Record segment # from map.

Segment Length: Record segment length from map.

Tree #: Tree number is just to help you keep track of where you are since this is a sample inventory. Start at a block end. The survey is taken by walking or driving up one side of the block and down the other. All trees are counted in ROW and medians (if applicable) for residences, businesses, parks and other maintained areas. Only survey trees over 6 inches in fencerows or wild areas. If you have more than 28 trees, use a sheet with blank tree number column and fill in 29, 30, 31… Fill in "Blockside Sheet ____ of ___" at bottom of survey sheet.

Median Tree: Circle 'M' if tree is in a center median strip. Mark map to indicate the total length of the median on the blockside.
Private Tree: Circle 'PVT' if tree is on private property **and** has 'Clearance Issues' - don't record Species, DBH Class, Condition Rating or Maintenance for this tree.

Species Code: From list. Write name in if not on list.

DBH Class: Measure or estimate DBH and assign to one of the following classes: 1 (0-5), 2 (6-10), 3 (11-20), 4 (21-30), 5 (31+). If forked, take diameter at narrowest point below fork. If multi-stemmed (i.e. crape myrtles), average the diameters of stems over 1" at DBH. For palm species, assign to class based on feet of clear trunk height (from ground to base of live crown).

Condition Class: Condition addresses the current state of the tree's health, structural soundness, shape, and growth rate. Rate the overall health and condition of a tree by analyzing root characteristics, trunk and branch structure, canopy, twigs, buds, foliage, and any presence of disease and pest pathogens. Classify and record the condition of each tree in one of the following categories adapted from the rating system established by the International Society of Arboriculture:
Good: Trees in this class are judged to be desirable and with regular maintenance can retain this classification. They have few signs of physical damage, decay, disease or insect damage, or deadwood in the crown, limbs or trunk, although they may be interfering with utility lines or are planted in an overcrowded location.
Fair: Trees in this category have visible signs of stress, including one or more of the following: thinning canopy or small leaves; premature fall coloration; limited insect or disease infestation; structural faults or poor form; mechanical stem damage, including evidence of past 'topping'; deadwood >3" in the crown, limbs or trunk.
Poor: Trees in this group are in a general state of decline, exhibiting major disease or insect damage, physical defects, over 50% of the crown has deadwood or other serious defects, or bark may be beginning to peel. Priority pruning is likely required (i.e., large dead wood is present that could cause significant harm or damage).
Dead: Trees in this category are either already dead or in such very poor condition that removal is warranted. These trees have over 90% dead branches and have completely succumbed to insects, pathogens, or nutritional deficiencies. Little or no live foliage is visible during the growing season.

Maintenance: Note if it is a private tree by circling PVT.
(RC) Road Clearance: Limb(s) is less than 14' over the curb or roadway or ***if tree is blocking traffic control device such as a sign or light.***
(SC) Sidewalk Clearance: Limb(s) is less than 8' over a sidewalk (or other hardscapes for parks and public facilities besides streets).
(TP) Training Prune: The final maintenance category is training pruning. Trees in this category are generally young, recent plantings. Minimum maintenance includes trimming root and trunk suckers, deadwood, crossing, diseased, or weak branches, and staking improvement or removal. Trees in this category need to be scheduled for maintenance and not neglected. Generally, young trees should be pruned to reflect their species' natural growth pattern or to a single leader or a strong central leader to promote the development of strong scaffold limbs.
(PST) Pests: Pests are present and of significant numbers that they may impact the health of the tree.

Priority:
PI*: Prune Immediate Priority. Requires immediate pruning – record under special notes at bottom of page. Trees in the immediate pruning category present possible safety risks to persons or property. Trees in this category are characterized by broken branches and large deadwood. Pruning should be accomplished as soon as resources are available.
PH: Prune High Priority. Trees requiring high priority pruning should be attended to as quickly as scheduling will allow. These trees, like the immediate priority pruning category, have broken branches and areas of deadwood. The dead areas, however, do not present an apparent immediate safety risk to persons or property.
PR: Prune Routine Priority. All other trees except young and recent plantings fall into the routine pruning category. They require removal of dead, dying, diseased, or obviously weak and heavy branches and deadwood. Routine, ongoing pruning should be scheduled and programmed to ensure all tree pruning is accomplished on a minimum cycle of five to seven years. It is important to remember that low priority problems can become high priority if they are not maintained for an extended period of time.
RI*: Removal Immediate Priority. Record under special notes at bottom of page. Trees categorized as high priority removals should be removed as soon as possible based on their lower condition class and proximity to active use areas or structures.
RR: Removal Routine priority. Low priority removals should be scheduled and accomplished when resources are available after high priority removals have been accomplished. These trees are generally located away from population areas and facilities.

(OU) Overhead Utilities: Trees are underneath or adjacent to overhead utilities.

Planting Sites: Medium or large trees to be planted if room. Under power lines, only small trees to be planted. Minimum 4-foot tree lawn needed to plant a tree. Record the number of planting spaces in Public ROW or Median. Also record number of planting spaces in Private Front Yards within 30' of ROW edge.
Distances From:
Utilities – overhead (15'); Hydrants, utility poles, and light posts (10'); Intersections (measured from corner) (25'); Driveways (5'); Other trees: 20-50'

TFS June 2011

Appendix B: List of Species Sampled and the Distribution of Each by DBH Class

Common Name	Scientific Name	Distribution by DBH Class					Tree Count	Percent of Total	Running %
		0-5	6-10	11-20	21-30	30+			
Live Oak	*Quercus virginiana*	27%	64%	8%		1%	190	24.1%	24.1%
Common Crapemyrtle	*Lagerstroemia indica*	60%	40%	1%			164	20.8%	45.0%
Loblolly Pine	*Pinus taeda*	19%	74%	8%			156	19.8%	64.8%
Hackberry	*Celtis species*	5%	63%	29%	3%		59	7.5%	72.3%
Yaupon Holly	*Ilex vomitoria*	96%	4%				57	7.2%	79.5%
Ornamental Pear	*Pyrus calleryana*	39%	61%				28	3.6%	83.1%
Chinese Elm	*Ulmus parvifolia*	76%	24%				21	2.7%	85.8%
American Holly	*Ilex opaca*	100%					17	2.2%	87.9%
Shumard Oak	*Quercus shumardii*	69%	31%				16	2.0%	90.0%
Sweetgum	*Liquidambar styraciflua*	36%	64%				11	1.4%	91.4%
Oriental Arborvitae	*Thuja orientalis*	22%	78%				9	1.1%	92.5%
Japanese Privet	*Ligustrum japonicum*		100%				7	0.9%	93.4%
Water Oak	*Quercus nigra*	71%	29%				7	0.9%	94.3%
American Elm	*Ulmus americana*	17%	50%	17%	17%		6	0.8%	95.0%
Chinese Tallowtree	*Triadica sebifera*		20%	60%	20%		5	0.6%	95.7%
Unknown Species	*Unknown species*		100%				5	0.6%	96.3%
Arizona Ash	*Fraxinus velutina*			75%	25%		4	0.5%	96.8%
Waxmyrtle	*Morella cerifera*	100%					4	0.5%	97.3%
Cedar Elm	*Ulmus crassifolia*	50%	50%				4	0.5%	97.8%
Red Maple	*Acer rubrum*	100%					3	0.4%	98.2%
Eastern Redbud	*Cercis canadensis*		50%	50%			2	0.3%	98.5%
Green Ash	*Fraxinus pennsylvanica*		50%	50%			2	0.3%	98.7%
Eastern Redcedar	*Juniperus virginiana*		100%				2	0.3%	99.0%
Black Willow	*Salix nigra*				100%		2	0.3%	99.2%
Pecan	*Carya illinoinensis*				100%		1	0.1%	99.4%
Southern Magnolia	*Magnolia grandiflora*	100%					1	0.1%	99.5%
Red Mulberry	*Morus rubra*		100%				1	0.1%	99.6%
Eastern Cottonwood	*Populus deltoides*					100%	1	0.1%	99.7%
Southern Red Oak	*Quercus falcata*		100%				1	0.1%	99.9%
Oak	*Quercus species*			100%			1	0.1%	100.0%

Total Number of Public Trees Sampled: 787

Total Number of Species Sampled: 30

Appendix C: Tree Replacement Values, by Species

*Values are calculated for each tree in the sample using its recorded condition class rating, an average DBH for its assigned class, an average location rating of 70%, and the State Average 'Basic Price' ($76 per square-inch) for a 3-inch caliper specimen, installed and guaranteed for one year. Values for palm species are calculated using an average height in 'brown trunk feet' (BTF) and a Basic Price for that species. Species ratings for species marked with # were determined by the regional forester.

Tree Species	Species Rating #	Average DBH/BTF	Estimated No. Trees	Average Tree Value*	Total Value	Percent
Live Oak	100%	8.2"	3,777	$2,232.81	$8,433,107	34.6%
Loblolly Pine	80%	8.1"	3,101	$1,663.96	$5,159,999	21.2%
# Hackberry	65%	11.3"	1,173	$2,462.17	$2,887,711	11.8%
Common Crapemyrtle	80%	5.7"	3,260	$858.45	$2,798,608	11.5%
Arizona Ash	71%	18"	80	$7,379.43	$586,767	2.4%
American Elm	73%	13.2"	119	$4,274.31	$509,800	2.1%
Chinese Tallowtree	66%	16.5"	99	$5,010.17	$497,973	2.0%
Ornamental Pear	60%	6.5"	557	$850.23	$473,234	1.9%
Black Willow	53%	25"	40	$11,072.54	$440,210	1.8%
Eastern Cottonwood	67%	30"	20	$15,117.16	$300,506	1.2%
Pecan	68%	25"	20	$14,206.28	$282,399	1.2%
# Yaupon Holly	70%	3.3"	1,133	$242.71	$275,010	1.1%
Chinese Elm	73%	4.7"	417	$539.15	$225,068	0.9%
Shumard Oak	80%	5.1"	318	$658.92	$209,573	0.9%
Sweetgum	67%	6.6"	219	$887.69	$194,105	0.8%
# Oriental Arborvitae	60%	7.2"	179	$1,038.45	$185,785	0.8%
Green Ash	80%	12"	40	$3,864.11	$153,625	0.6%
# Oak	75%	15"	20	$5,640.73	$112,129	0.5%
# Unknown Species	50%	8"	99	$1,069.65	$106,315	0.4%
# Japanese Privet	30%	8"	139	$641.79	$89,305	0.4%
Eastern Redbud	45%	12"	40	$2,173.56	$86,414	0.4%
# American Holly	80%	3"	338	$237.13	$80,135	0.3%
Water Oak	68%	5"	139	$547.14	$76,135	0.3%
Cedar Elm	78%	6"	80	$951.65	$75,669	0.3%
Eastern Redcedar	87%	8"	40	$1,861.19	$73,995	0.3%
Southern Red Oak	76%	8"	20	$1,625.87	$32,320	0.1%
Red Mulberry	56%	8"	20	$1,198.01	$23,815	0.1%
# Waxmyrtle	50%	3"	80	$150.42	$11,960	0.0%
Red Maple	45%	3"	60	$124.10	$7,401	0.0%
Southern Magnolia	53%	3"	20	$159.44	$3,169	0.0%
		Estimated Totals:	**15,647**	**Avg: $1,559 ea**	**$24,392,243**	