DOUGHERTY VALLEY

TREE AND PLANTING STRIP MANAGEMENT PLAN

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DOUGHERTY VALLEY

TREE AND PLANTING STRIP MANAGEMENT PLAN

EXECUTIVE SUMMARY

The Dougherty Valley Tree and Planting Strip Management Plan was developed after six months of dedicated work by Dougherty Valley residents, City staff, and the CalTLC consultant team. California Tree and Landscape Consulting, Inc. (CalTLC) was retained by the City of San Ramon to assist in developing ways to resolve damages caused by trees planted along residential streets Dougherty Valley. We were asked to work with a Citizen's Tree committee to obtain public input on how best to resolve the problems in a way that would be considered acceptable to the citizens of Dougherty Valley.

The Dougherty Valley Citizen's Tree Committee was selected and assigned by the San Ramon City Council. The committee met an average of twice a month to discuss existing conditions, and learn what future changes from the existing trees could be expected. The Committee discussed potential solutions, prioritized the remedies they thought would preserve neighborhood character and be acceptable to the residents, with the goal of developing a plan for recommendation to City Council.

Dougherty Valley subdivisions were not built in alignment with the Dougherty Valley Specific Plan, Dougherty Valley Design Guidelines, or reasonable design principles for sustainable urban forestry. The primary problems are: soil compaction, poor selection of tree species, lack space for trees both above and below ground and turf used in the planting strips. As a result, the trees have damaged irrigation systems, utilities, and sidewalks, leading to premature tree removal. The problems are only going to increase as the trees grow larger.

The primary recommended approaches include:

- planting appropriate tree species in the available growing space;
- remediating soil areas to reduce compaction and improve soil fertility;
- removing turf from the planting strips and installing wood chip mulch, landscape plants and new irrigation;
- enlarging the growing space for existing and new trees where feasible;
- removing trees where necessary to improve tree spacing and repair infrastructure damage; and
- managing tree species to improve diversity over time.

The Dougherty Valley Tree and Planting Strip Management Plan explains the tree assessment, existing conditions, and technical urban forestry management approaches that can be applied to the infrastructure and trees. The concerns of both the residents and City staff for the plan were to minimize the impacts to the neighborhoods and to be affordable. We believe the Plan provides the optimum solutions to improve and enhance the Dougherty Valley Streetscapes while reducing the problems associated with intrusive tree roots.

Projected savings based on reduced irrigation and turf and tree maintenance costs provide a significant funding opportunity for successful implementation of the plan. The residents' desires to retain many of the larger tree species in small planting spaces is the biggest challenge the community will face with this Plan. The trees simply do not have adequate space to grow to their mature size. The Plan provides tools to make consistent decisions to address the challenges of infrastructure damage that will continue to develop as the trees grow.

PURPOSE OF THE MANAGEMENT PLAN

GOALS AND OBJECTIVES OF THE PLAN

- Maintain an urban forest canopy that provides the citizens of Dougherty Valley with the benefits of trees[1], including:
  - urban heat island reduction,
  - storm water interception,
  - air quality improvement,
  - energy conservation,
  - shade for pedestrians, and aesthetic appeal.
- Maintain a sustainable tree canopy along the streetscapes of Dougherty Valley and work to retain adequate space for growing the right trees in these areas.
- Serve as a guide for City actions to develop a long-term, multi-year plan to manage the existing infrastructure conflicts and future infrastructure projects that may impact the streetscapes.
- Identify methods to prioritize tree and turf replacement.
- Provide a series of options for Tree Retention or Tree Replacement based on the amount of infrastructure damage, and the ability to complete the repair without impairing the stability of the tree.
- Reduce the environmental effects of the loss of individual trees, as longer-term replacement canopy is being grown.
- Reduce water use, consistent with State of California laws and regulations.
- Reduce public expenditures
- Consider wildlife and bird impacts in tree management and removal strategies.

CHALLENGES OF THE PLAN

The biggest challenges for this process are:

- Most of the planted areas are not consistent with the Dougherty Valley design guidelines
- Planting strips are too narrow to support the large sized shade trees that were planted
- The insufficient planting strip widths are continuing in new community development. A 2012 Tree Associates[2] report recommended that only wider planting strips be used for larger sized trees.
- The typical placement of trees is too close to utilities, driveways, and street lights, while trees are missing in bulb-outs that appear to be designed for large trees.
- Trees are often spaced too close together to allow them to reach mature size.
- Infrastructure damages and repair costs will increase as the trees get larger.
- Basing tree related decisions on homeowner wants or desires without policies and tools to guide the choices results in inconsistent and varied streetscapes.
- Implementing tree planting following the adopted plan has suffered resistance from citizens in locations where trees have been removed and not been replanted.
- Varied site uses in the community, such as around schools, may require a different approach to turf in planting strips than in front of homes.

[1] I-Tree is a program developed by the USFS that calculates the annual benefits of trees by calculating their positive impact on the storm water retention, energy conservation, absorption of pollutants and sequestration of carbon. www.treebenefits.com and www.itreetools.org. Also See Appendix 6, page 38.

[2] 2012. Tree Associates. Winters, CA.

Maintaining the Dougherty Valley Tree Canopy

Developing a sustainable tree canopy cover provides a multitude of benefits and services to communities, including energy conservation, air quality improvement, heat island reduction, shade for outdoor use, and providing habitat for native birds and wildlife. Trees are assets whose value to the community should be included and considered in the community's general plan, development process, and annual budget.

Urban forestry manages the community's tree population. While each tree can be important, it is the cumulative canopy that defines a community's tree resource. The two diversity needs are species and age -

- species diversity improves the forest's resilience to disease and insect problems;
- age diversity provides a varied size of trees, as well as varied maturity. All populations need to have young trees replacing older trees, or potentially face the death of large swaths of trees at one time.
- In new plantings, age diversity is challenging because all the trees are planted at the same time. But as trees grow at different rates and some are replaced, age diversity begins to improve.

The process to set a community wide canopy goal is to recognize the importance of canopy and:

- analyze and measure the existing canopy
- create a stated goal to achieve a specific canopy cover percentage
- create the canopy cover plan, which includes several components
- periodically evaluate if the goal is being achieved

Current thought in age diversity is to have no more than about 40% of the tree population in the smallest diameter class (less than 6 inches in diameter). Too many in the smallest class of trees means the city would not receive the full benefits of a tree canopy. When too many trees are in the larger diameter classes, concerns arise about mortality and replacement.[3]

Resolving the primary challenges of over-planting and limited growing space will affect the long term sustainable tree canopy. The optimum plan will identify and maintain the existing tree species that will grow long term in their planting space. The plan could also identify sites where space can be enlarged to retain existing trees for a longer time without conflicts and infrastructure damage. When trees are replaced, selecting species that will grow long term in the available planting space will provide the greatest long term sustainable tree canopy that is the wisest investment of maintenance resources.

Those trees that do not fit the long-term model should ideally be replaced before the expensive infrastructure damages occur and receive only minimal maintenance to manage risk – such as pruning low branches, dead branches, and weak branches that may fail, and plan the cycle of tree replacement. When this can be done with minimal investment, the City avoids spending a lot of money on trees that will be removed in the short term.

Irrigation damage is challenging to monitor because it is underground and hard to observe. If the approach to remove the turf and replace mulch in planting strips is adopted, irrigation modifications during the turf conversion may avoid some of the current irrigation line damage.

The DV Tree and Planting Strip Plan includes a matrix and steps for staff to make consistent supported decisions on tree removal to avoid the costly damages. In those situations where adjacent resident cooperation is required such as to provide easements to relocate sidewalks or accept alternative sidewalk materials, existing trees may be able to be retained for many more years.

[3] Designing Urban Forests, *Adapted from:* McPherson, G., J.R. Simpson, P.J. Peper, S.E. Maco, and Q. Xiao, 2005. Municipal forest benefits and costs in five U.S. cities. *Journal of Forestry*. 103: 411-416. *Adapted by Melanie Lenart, University of Arizona*

DOUGHERTY VALLEY TREE COMMITTEE

We were asked to work with a committed, engaged, and interested group of citizens known as the Dougherty Valley Citizen's Tree Committee, who are passionate about their community, had personal desires, and are looking out for the best interests of the City.

The Citizen's Tree Committee was appointed by the City Council in February 2017 and assigned to:

- Provide public input on how best to resolve the problems created by tree root damage to sidewalks, and water and other utility lines throughout Dougherty Valley.
- Review current conditions of the landscaping and tree issues as presented in the various consultant reports, staff reports, photos and observations
- Review professional input and recommendations from the consulting arborists on the current conditions of the potential future impacts
- Review landscape design guidelines and other aspects of the DV Specific Plan and the DV Community Design Handbook
- Hold Committee meetings and public work sessions to discuss various options and present scenarios
- Develop short term and long-term options and future implementation strategies
- Make recommendations to Council for considerations to be included in the DV Tree and Turf Strip Management Plan.

***Photo 1**. Trees growing alongside Bollinger Canyon Road*

THE DOUGHERTY VALLEY TREE AND PLANTING STRIP MANAGEMENT PLAN

INTRODUCTION

Planting strip width is the most fundamental constraint on the overall streetscape design of Dougherty Valley and its subdivisions. Functionally, the design was to have large trees growing along the main arterials and collector streets in areas with at least 8 to 12' planting strips. The residential neighborhoods were planned to use smaller maturing species, and have less shade provided by the public trees. Should a homeowner decide they truly want more shade, it would be up to them to provide it on their property, undertaking the cost of the planting and maintenance, including any infrastructure that may be damaged.

The primary way to avoid the huge future maintenance costs in perpetuity is to choose species that fit the sites as designed. In some specific areas, it may be possible to gain a foot or two in planting strip width. How often this is done, and how it fits the available space are decisions that should meet a set of criteria. To move the sidewalk outside the public right-of-way, an easement from the adjacent property owner is the best partnership. This design change to the planter strips would be undertaken in cases where larger trees are desired to be retained.

The first draft of the Dougherty Valley Tree and Planting Strip Management Plan (hereafter referred to as the PLAN) proposed replacing tree species on streets that have already experienced the conflicts of the current design. Most of the trees have only been growing for 6 to 10 years, but the damages to irrigation, utilities and sidewalks are disruptive and costly. Costs will increase as the trees continue to grow.

The Tree Committee choice is to retain as many of the original trees as possible, coupled with some remediation of existing growing conditions and experimental techniques and materials, such as modular walkways. They recognize that the cost of repairing the damages as the trees grow older will increase and may still result in some of the trees being removed. In some communities like Mill Valley, they accept those costs to retain the large trees. A first step in the proposed plan is for new trees to be planted where space is available, improving the age diversity on the streets. In some cases, new species will be chosen.

The tools in this plan are thoughtfully considered after listening to staff history and actions, as well as the Citizen Tree Committee's feedback on the Dougherty Valley PLAN, field observations, and urban forestry research and best practices.

The intent is to provide:

- a consistent landscape for the community,
- techniques for staff to make findings-based decisions for each street, and
- maintenance practices consistent with the design handbook intent.

Photo 2. London Plane trees planted in Mill Valley in 1900, prior to the street being paved or having sidewalks. Today citizens tolerate the inconveniences of the trees because they love the neighborhood.

Basing their concerns on fiscal responsibility and the Dougherty Valley Community Design Handbook, staff previously proposed a more aggressive approach to modify existing species on specific streets to reduce further infrastructure damage and achieve the goals of the original plan. This was not preferred by the committee as the desired approach.

This plan has been developed with the big picture of the Dougherty Valley streetscape and the trees' long-term management in mind. The plan is based on sound urban forest practices with the intent to achieve a sustainable maintenance budget.

Photo 3. *Trees and landscaping on South Gale Ridge, a Collector Street.*

Three options are proposed for action. Costs for the Proposed Options will vary significantly. The least expensive long-term choice will be Option 2, although there would be greater upfront costs as well as greater potential savings from small tree and turf grass replacement. The costs of the Option 1 preferred by the Citizen's Committee may be higher, but the benefits may be greater in terms of tree resources and community appeal. The third option is responding to requests by property owners.

PLAN OPTIONS

The Tree Committee is presenting three options for the Council to consider addressing the challenging situations of the existing conditions and future concerns. The consultants, and staff provided a wide range of actions to implement with their corresponding outcomes. The three options are presented to demonstrate the comprehensive review of the situation and possible response actions.

Option 1 is the consensus choice of the Committee, as the reasonable sustainable alternative. The costs referred to in each option are based on current city contracts and other similar costs for the same work in the Bay Area. Costs may vary - up or down - depending on specifications, quantities, and timing of contracts

CITIZEN'S TREE COMMITTEE PREFERRED OPTION 1.

This Option provides a strategic process for developing an initial Annual Plan followed by a multi-year plan to address trees that are creating damages to utilities, irrigation and sidewalks within Dougherty Valley residential streets. The goal of this Option is to retain existing trees for as long as possible. The Annual Plan will focus the first activities at existing service call locations, and then move to a planned sequence of locations to address trees based on severity of damages and size of planting strips. Turf will be replaced around the trees as sites are repaired, or replaced for the entire valve distance in the planting strip as trees are replaced.

Option 1 includes using reasonable tree care best practices, along with increased community review of progress on an annual basis.

- Each year, develop an Annual Work Plan based on staff assessments of the sites to determine what the situation is, and what options are available for mitigation. The annual plan should include review of the previous year results and costs in support of the budget formulation.
- The first plan will likely occur mid-year, and will begin with addressing the existing service requests.

The process will be:

1. Sort the existing requests by address, group them in geographical areas, and work by neighborhoods. When there are several requests on one street, assess the options and develop proposed measures for the street before any work is scheduled. Follow the tools and actions in the Implementation section of this report. The Plan should include the specific trees to be preserved and root pruned, those to be replaced, and those to be removed and not replaced (if any).
2. On blocks where several trees need replacing (based on the matrices in Appendix 2, page 19, and recommended tree species in Appendix 3 page 21) decide which replacement tree species is going to be used for the block and replace the trees with the new species. Maintain proper distance from utilities and concrete, and proper tree spacing.
3. When trees are replaced, use soil remediation techniques prior to planting and replace the turf with an appropriate ground cover.
4. On the same block, if there are trees that can be retained, repair the damage that has been caused using the appropriate actions and tools.
5. Decide at that time if the turf should be replaced with a ground cover around the retained trees, or if it should only be pulled back 5' away from the tree and replaced with mulch.
6. Notify the homeowners on the street what the plan is and when the work will be completed. Provide them with a contact, or schedule a specific time to discuss the plan with them, possibly on site.

Working on the service request sites first accomplishes three important actions:

1) It responds to inquiries put on hold during the committee process; and
2) provides opportunities to test and confirm the proposed actions are workable, and verifies cost estimates.
3) provide notice to, and receive feedback from, the citizens on the proposed project plan.

The service request work will be the first priority in the planning and budgeting preparation for completing the rest of the work in the same area with the same size planting strips and size of trees. While the existing service requests are completed, staff will complete an assessment of the other sites in the area to determine the most critical sites to work on as the next step. The work, budget, and outcome will be evaluated after the first two steps – service requests and 1st phase of the work - so future assessments and budgets can occur in a timely manner, and receive the community feedback built into the plan.

On all repair sites, turf should be removed from around the tree, or from the entire planter strip, depending on the severity of current damage to the irrigation system. When a block of trees is necessarily replaced, remove the turf in that planting strip, and choose a ground cover for the site. Ground covers should be just as varied as the tree species, to discover over time which ones are most resilient and which ones are most compatible with specific tree species. Diversity of trees, as well as ground covers, is an important management characteristic throughout the community.

The second Annual Plan will then progress to new service requests and locations, as identified by staff assessments.

The tree replacement cost will range from $250 to $450, plus the turf conversion, so final costs per site will range from $720 to $2,250. Cost savings should be significant, but less than a more aggressive approach of replacing all trees on the block at the same time.

As the first Annual plan is being developed, a knowledgeable Certified Arborist and Landscape Architect should work with staff to develop a detailed list of streets with recommended tree species for each of the 56 neighborhoods, along with appropriate ground cover species. This list should consider some research of existing plants growing in San Ramon as well as experimental plantings in parks to assess new ground covers. It should be reviewed and approved by the Tree Committee.

OPTION 2. CHOOSE TO REDUCE LONG-TERM COSTS AND REPLACE THE TREES IN THE SMALLER PLANTING STRIPS BEFORE THEY CAUSE ANY MORE DAMAGE TO IRRIGATION SYSTEMS OR THE SIDEWALKS. REPLACE THE TURF IN THE PLANTING STRIPS AT THE SAME TIME.

This approach includes working on selected streets to remove and replace tree species too large for the planting strip before any damage expenses are realized. The prioritization of streets or blocks will be based on size of the planting strip (smallest strips first), anticipated size of the species currently planted, and age of the sites, and will be a more aggressive approach to prevent further infrastructure or utility damage. When trees or irrigation are replaced the turf will be removed and mulch and landscape plants will be installed. Soil remediation will also be implemented to correct the soil compaction.

For the first year, existing service requests will be planned geographically and completed. While the service request work is being performed, staff will assess the next phase. Once the service requests are completed, the first sites to be addressed will be the 4’ wide planting strips with potable water and trees too big for the available planting strip. Once the 4’ planting strips with potable water are completed, the 5’ wide planting strips with potable water will be addressed. Once the potable water sites are completed, the sequence will be the 4’ wide strips with trees too large for the planting strip, and then 5’ wide strips. With each annual plan, the service requests will be responded to.

The same assessment, notification, and replacement tools will be used for Option 2 as in Option 1.

This option may require Capital outlays above and beyond the annual Maintenance funds. The costs will range from $480 (lower tree removal cost for smaller trees), the tree replacement cost of $250 to $450, plus the turf conversion range from $720 to $2,250. The cost savings will be based on cost avoidance, since every tree that is replaced before concrete damage occurs can be expected to save at least $900. Additional cost savings will also be from reduced turf irrigation and maintenance.

This option was not desired by the Committee. They felt it was too aggressive and will remove too many trees and replace them with smaller scale trees in an indiscriminate manner, and it would result in too drastic a change to their neighborhoods.

OPTION 3. RESPOND TO REQUESTS FOR SERVICE. ALLOW THE TREES TO GROW AS THEY ARE AND FIX THE PROBLEMS AS THEY ARE REPORTED WITHIN THE ALLOTTED BUDGET AND STAFFING.

Neither the Committee nor the Consultants consider this a viable option. Too much time and energy has been spent with the Citizen Tree Committee to not gain some improvement to the future streetscape designs and budget management.

Option 3 results in unplanned service request responses to damages. The trees will grow larger and damages will increase, and service request calls will increase in volume. If nothing is done until the sidewalk is damaged, the costs will range from $900.00 to $1,350.00 per tree site. Tree removal and stump grinding costs range from $480 to $790. The cost of tree planting is $250 to $450 per tree, and landscape conversion from turf to mulch ranges from $720 to $2,250 depending on planter strip size. The total range of costs when the sidewalk is repaired range from $900 to $4,840 depending on the size of the tree, tree removal, tree planting, and turf to mulch conversion.

IMPLEMENTATION TOOLS AND ACTIONS FOR ALL OPTIONS

Annual Plan Review

An Annual Work Plan will be developed each year along with the budget. A quarterly report of the completed work in the current year would keep the community up to date. The year-end report should review accomplishments for the year and be compared to the proposed plan for the coming year.

Multi-Year Plan Approach

The committee wanted a long-term approach with a multi-year focus as well as an annual work plan. As the first annual plan work is completed and the sites are assessed, a multi-year focus will support longer term budgeting, prioritization of sites, and realization of cost savings.

Homeowner Notification

The need to clearly explain the Annual Work plan to the public is important for The Plan to be successful. Information handouts will need to explain what is occurring at the individual properties, and what is occurring along the entire street. Scheduling and City contact information are important for inquiries to be efficiently communicated.

Enhance existing canopy by replacing dead and dying trees and then by thinning out overcrowded trees.

In reviewing the tree inventory, we learned there are 69 recommended removals based on poor condition, 230 stumps of previously removed trees, and 2039 vacant sites where trees were removed that are available for new tree planting (potentially up to 2,269 new trees). As an initial component of the program, focus on enhancing the landscape first by planting trees, while the chosen option is being initiated. Once the new trees are planted, thin out overplanted trees so the desired remaining trees can gain more room to grow to maturity.

Prioritize tree replacements based on current infrastructure damage.

The overarching goal is to retain as much canopy in Dougherty Valley as possible to retain the character of tree lined streets, but this needs to be accomplished in a sustainable manner.

If a tree can be retained without causing an unacceptable expense or risk, the removal should be delayed. The delay of removals will retain a similar look on a street. The phasing of removals on streets can retain as much canopy as possible during the transition to more appropriate species for the growing space for the long term.

Soil Remediation and Tree Planting

When trees are removed and/or the irrigation system is replaced, soil remediation should be performed to reduce compaction, improve the soil permeability, and soil quality in the planting strip. There should be a standard amount of organic amendment used at each site and specifications developed for how to till and amend the soil. This language should be placed in the Landscape Contract Specifications.

Sidewalk Materials and Alternative Designs

Alternative materials include porous concrete, rubber sidewalks, and permeable plastic modular sidewalks. We showed slides and discussed these alternative in detail with the Tree Committee. Permeable materials allow water and air to seep through the walkway and can encourage the development of deeper roots over time. Thinner materials create more rooting space, and last longer than the traditional concrete sidewalks. Because concrete cracks over roots, more roots must be removed when repairs are made to protect the concrete walkway. Greater root removal may impact tree stability and health.

In some situations, temporary repairs may be needed to reduce liability of a displaced sidewalk. Temporary repairs include: grinding the offset level; saw cutting the offset level; ramping or patching the offset with asphalt fines (cement dust should be placed over the final surface of the asphalt. The gray color absorbs some of the oils, reduces the heat absorbed by the asphalt so it stays harder, and looks better than black asphalt); the sidewalk can be torn out and replaced with a temporary asphalt sidewalk (cement dust coating applied for the same reasons); or other alternative materials may be used for the sidewalk.

Usually, a step separation or significant slope angle are the triggers to perform the temporary or permanent repair. In court cases, offsets as small as ¾ inch have been called the threshold for whereby an agency should have acted to correct the offset before an incident occurs. This can be lower around senior housing or children gathering areas. For simplicity, our recommendation is to use 1” as the minimum offset to trigger a concrete replacement. Less than an inch can receive a temporary repair.

In some situations, the longevity of a tree may be extended by replacing the adjacent sidewalk with an alternative material to concrete, or moving the sidewalk over, or both moving the sidewalk and using an alternative material. Choosing this option will be based on:

- the structure and health of the tree - at least fair condition;
- adequate space between the trunk and the sidewalk to install a level, ADA compliant walkway;
- if the sidewalk is being moved closer to the house, there is adequate space between the new sidewalk location and the adjacent home; and
- the condition of the curb and gutter is serviceable, not damaged or causing ponding of water.

Ways to Address Sidewalk Damage:

- When a street has a species too large for the available planting strip width, and the sidewalk cannot be moved over, the tree causing the damage and adjacent trees of similar size should be removed. The trees would be replaced with a species more appropriate for the planting strip width.
- When a street has a species too large for the growing space, and the citizens want to retain the trees, it may be possible to relocate the sidewalk farther from the tree on private property, creating more growing space. The tree can continue to grow, until they get too large and start displacing the curb and gutter. The curb and gutter can also be moved, although it usually results in the loss of an on-street parking place. If the tree is displacing too great an offset of the curb and gutter, the tree will likely need to be replaced. This alternative of relocating the infrastructure to give the tree the necessary growing space may increase the cost of tree retention over the lifetime of the tree. To move a sidewalk onto private property, a sidewalk maintenance easement can be agreed upon with the adjacent property owner. The City could consider asking the adjacent homeowner to participate in a portion of the cost.

- Where planting strips contain appropriate tree species, but still experience sidewalk damage, replace the sidewalk in a similar position with an alternative material that allows for tree conservation. Modular sidewalk materials now exist that are thinner than concrete and permeable. The benefits of modular materials are greater soil volume and growing conditions for the tree roots. The walkway can be lifted, tree roots pruned, and the same materials re-used. This reduces future repair costs and retains the consistent site appearance.
- Temporary repairs can be made to reduce the liability of a displaced sidewalk when adequate funds are not available, or a decision cannot be made at the time a sidewalk condition is discovered. Temporary repairs include sidewalk grinding, saw cutting, patching or ramping, and in significantly offset concrete – remove the concrete and replace temporary asphalt or other materials. When asphalt is used, the surface should be coated with dry concrete "dust" as explained in the sidewalk materials and alternative design above.

Sidewalk replacement may require tree removal at a site, while temporary repairs can delay tree removal at that site. The assessment tools will allow staff to make the best decisions for site mitigation and tree retention or removal.

Assessment for each street and planting situation

A detailed plan for each block should be developed, based on current species present and the amount of damage that has occurred or is expected to occur within the next 5 years. If the trees are healthy and no damage is expected within the next 5 years, place that block on a lower priority for work.

Focusing on the combination of oldest sites and limited planting strip size, develop a priority based strategy for retaining or replacing trees. Where trees are damaging infrastructure, choose a species from the recommended list and develop a time frame for replanting based on number of vacant tree sites, number of irrigation breaks, and amount of damage to infrastructure.

Improve Species Diversity and pay close attention to which species are used where

Optimum Urban Forest best practices promote a population that contains no more than 10% of any one species *(purple leaf Plum*), 20% of a Genus *(Prunus),* and 30% of a Family *(Rose).* This is designed to reduce catastrophic tree losses when a disease or insect that is species specific arrives in your community. Two ways to achieve diversity in a community include alternating tree species on a street, or designating streets with 1 or 2 tree species and balance the number of streets with different species. There are two species shown in the inventory summary in Appendix 3, page 23, greater than 15% in Dougherty Valley – London Plane, and Ornamental Pear.

Planting 2 species on a street can be helpful in providing a more resilient canopy by reducing the ability for catastrophic insects or diseases to wipe out the entire street canopy. The current plantings of Trident maple and crape myrtle as replacements are a good example on street where the current trees were found to be too big for the planting space. An important priority of the tree committee was uniformity on streets, so trees with similar characteristics should be planted together to retain a more uniform tree canopy appearance.

Species with a high population percentage should not be used on new local streets. Plant these species only on existing designated streets, so their percentage of the overall population will be reduced.

Maintain appropriate and consistent tree spacing for optimum canopy development

Tree spacing – the distance between trees - is defined for each species as that needed for the trees to grow to their full canopy potential. Removal of adjacent trees should be scheduled when the canopies of adjacent trees begins to overlap or conflict with each other and the trees will continue to grow larger.

The most challenging spacing is where trees are planted on both sides of the sidewalk and are too close together. The first criteria to look at is the rooting space. Some of the trees are planted between a wall and the sidewalk in a very narrow strip. Those trees will receive consideration for removal based on the limited growing space. In these situations. remove the trees between the sidewalk and the wall, and space out the trees along the planting strip if needed. Around parks, where there is ample growing space on the park side of the sidewalk, remove every other tree on one side of the sidewalk, and the alternating every other tree on the planting strip side of the sidewalk so each tree has space to grow a

full canopy. The ideal tree spacing for each species is equal to the ultimate spread of the tree's canopy and is included in **Appendix 3, pages 23**.

Removing trees for canopy space will remove trees that are healthy, and structurally sound. They are being removed as an established forestry practice to allow adequate space for the long-term growth of the remaining trees, and will continue to gain a net increase of the community canopy.

Replace turf in planting strips with natural mulch, and low water use landscape plants with some stepping stones or walkway across the strip at the front entrance to homes. Eventually eliminate most turf strips on residential streets, especially those using potable water.

The simplest agreement the committee made was that turf around trees is not a good idea. The primary reasons are:

- the watering pattern causes more surface roots,
- the lawn maintenance has damaged too many tree trunks and roots,
- turf requires a greater water use and maintenance effort.

At the same time, the lawn has aesthetic appeal so the Committee wanted a phased approach to turf replacement. In locations where the turf will not be removed for a few years, place mulch in a rectangle, 4 to 5 feet on either side of the tree for the entire width of the planting strip width. This will improve the soil texture and aeration around the tree for improved growth, and avoid the "accidental" wounding of trees by lawn mowing equipment. It may also allow the placement of bubbler irrigation over the root system of the tree.

Replacing turf with mulch alone provides less color in the community. Staff has already experimented with several lower growing shrubs and ground covers and achieved a good palate of plants, and others can be added to create more variety, color themes, and interesting appearance. In planting strips receiving mulch in areas longer than 12 feet between a walkway or driveway, some modular walkway of a minimum dimension of 18 to 24 inches wide, made of either concrete, decorative stepping stones, bricks or pavers, are recommended to provide a clear pedestrian path across the planting strip to the front door. This accomplishes three important things:

- avoids damage to drip irrigation parts by people randomly walking across the mulch,
- provides a firm footing for high heels and shoes that may sink underfoot in wet soil conditions, and
- modular walks can be adjusted if needed

Convert Irrigation from overhead spray to bubblers.

Replace spray irrigation systems with bubblers. The typical valve may cover 5 to 12 homes. When plant material is converted from lawn to low water use shrubs and mulch, convert the irrigation to bubblers. Usually the entire valve area needs to be replaced at the same time, although in some cases drip emitters can be added to a spray head system by replacing the head with a bubbler head, leaving other heads as sprays. This would need to be overseen by an irrigation specialist.

There should be a minimum of 2 bubbler emitters per tree. The bubblers should be fitted so they are adjustable as the trees grow. The initial position is over the root ball of new plantings, since the only root system is what comes in the container. The bubblers should provide water around the base of the tree, and cover an area up to 5 feet from the trunk. After 2 years, the bubblers should be moved farther from the tree to cover a larger area. This irrigation adjustment needs to be included in the staff work description and the maintenance contract.

Improve Planting Specifications and Techniques

Improved planting specifications need to be adopted and followed. For #15 containers and 24" box trees, it appears that City staff is planting the trees according to industry best practices, and root problems appear to be reduced for the short term. The Planting Specifications that are included in contract documents need to be quite detailed not only as to planting, but also as to appropriate selection and purchase of trees, and the rejection at delivery of poor quality trees that arrive from the nursery.

Bare Root Trees

To budget most efficiently for the new plantings, an annual plan for tree planting should be developed each fall so the number and location of trees to be replaced are known. The removal of trees can take place in the winter, avoiding bird nesting season and retaining the trees during the summer when shade is needed. The planting strips can be prepared with newly tilled and amended soils and irrigation systems can be installed. The new trees could be ordered as bare root trees instead of container trees. There are many advantages to using bare root nursery stock:

- The trees are less expensive by at least one third the cost
- The holes dug into prepared soils are a minimum size
- Trees do not weigh much and can be planted by the citizens
- You can see and place the roots in the optimum location for future growth.
- Staking is much easier, and the establishment period for the trees is greatly reduced.
- Within 2 years the trees will be larger than the #15 container trees currently being used.

Bare root trees require additional care: be certain the roots do not dry out, and the trees obtain adequate water in the first 2 months. The size of bare root trees is smaller, so the use of mulch and protective staking will improve their survival. A triangular staking pattern will create a frame around the trees. Cross bars have been used with two stakes in windy areas, and the cross bar has damaged tree trunks and branches. The triangular staking will reduce damage to trees.

Provide for large trees in large spaces

The arterial streets have the best opportunity for large scale trees and canopy. The lack of turf has avoided lawn mower damage to the trees. Some trees are overplanted, and the spacing can be managed as the trees continue to grow. In situations where there are trees on opposite sides of the sidewalk too close together, every other alternate tree on the opposite side of the sidewalk can be removed to provide the space for the trees to grow to their normal crown size, and provide a long-term canopy.

Areas that have “orchard” plantings of Flowering Plum can be thinned, or replanted in a phased approach to grow larger trees in the larger planting space. We promote the phased approach whenever possible, understanding that some situations cannot be phased, because there are many dead or poorly performing trees in these plum “orchards”.

Improve Landscape Maintenance and Tree Service Contract Specifications

Review the landscape maintenance contract.

- Require trees and plants that die because of irrigation leaks or failures to be replaced. Obtain assistance from the manufacturer of the irrigation controller program, if it is not functioning as intended. They should be able to provide additional training and troubleshooting if irrigation breaks are not being identified.
- Include moving bubblers away from tree trunks in new plantings after 2 years.
- Require the mulched areas around trees to be increased in size as the trees grow to prevent injury by lawn mowers.

Review the Tree Service Contract. While most of the work appeared to be performed to industry standards in the form of how cuts are made, there has not been adequate attention paid to tree structure, where cuts would be made in different locations. The costs should be similar. When trees are young, they should be pruned at least every 3 to 5 years to maintain a central leader and improve branch structure to reduce long term maintenance problems as the trees grow. The temporary and permanent branches are treated differently until the temporary branches are removed and only the permanent branches remain.

COSTS OF THE PLAN IMPLEMENTATION

Costs cannot be accurately determined until the Option to implement is chosen and the various types of actions are known. One factor that needs to be considered is that contract services tend to be less expensive per unit of service if the amount of work is known at the time the contract is offered.

The costs of Option 2 have been projected by staff in a 2016 finance committee report[4] that outlined the proposal to proactively replace trees that were causing infrastructure damage, as well as replacing the turf in planting strips less than 5' wide. The tree inventory shows the numbers of trees in this report to be accurate. This report stated that the cost of removing 518 trees and replacing them with 380 smaller trees averaged $873 per replaced tree. Staff predicted that the total costs of the program would be $6.5M, but that $1.44M savings would be offset by water and labor costs after turf conversion, leaving a net cost of $5.1M. Further savings would result from avoidance of repairs to infrastructure damage.

With Option 1, there would still be avoidance of some costs to infrastructure damage, and savings from turf conversion, although to a smaller degree because the work would proceed more incrementally. The costs for tree replacement can be expected to be similar as for Option 2, although the numbers of trees cannot be predicted until the first Annual Plan is developed and reviewed at the end of the year.

There are 2,269 places available to plant trees now, based on the City's inventory of stumps and vacant sites. Were these to be replaced in the first year, at a cost of $250 per #15 container tree, the total cost would be at least $567,250. This could increase for two main reasons:

- Sixty-seven sites will require the stumps of the old trees to be removed before planting can be completed
- Irrigation repairs may be required
- Soil remediation should take place, since poor soil condition may be the reason the tree did not thrive

Total annual costs of maintain turf strips less than five (5) feet wide is $795,250. This should be reduced significantly over time, as the streets with the smaller planting strips are addressed and the turf strips are replaced with low water use shrubs and mulch. The costs for annual maintenance and water for the turf strips are estimated to be reduced by 50% once the turf conversion work is complete. The actual costs of implementing certain options and alternatives can vary significantly depending on the scope and amount of action undertaken.

It will be less expensive to do the work systematically because there will be a contract savings due to the scale of the work, and reduced travel time. And if the work is done conscientiously over the next 5 years, the cost savings will be more because many of the trees will not have grown large enough to cause conflicts, avoiding those infrastructure repair costs.

Involving residents, business owners and community service organizations can create more awareness of what trees do for the community and provides broad support for better tree care.

Involve citizen groups to work with the City or through special neighborhood events to plant container or bareroot trees on certain blocks to save costs and get neighbors involved. Tree planting is a very positive way to bring the community together and increase neighborhood engagement. This could be done as an Arbor Day celebration in support of the Tree City USA program, or with other nonprofit organizations leading the coordination with the citizens. Participation in planting through a Beautification Committee or non-profit tree group, such as Tree Davis, CityTrees, or the Sacramento Tree Foundation can be very beneficial.

[4] Finance Committee Staff Report, March 2016. Prepared by Jeff Gault, Operations Division Manager.

At the time of this report[5], the following costs were considered for decisions and savings:

- Remove and replace concrete sidewalk will cost approximately $18 per square foot.
- Remove and replace the driveway will cost approximately $20 per square foot.
- Sidewalk repairs (50 ft^2 to 75 ft^2 per tree) - cost range of $900.00 to $1,350.00 per tree.
- Remove and replace concrete curb/gutter and pave adjacent asphalt is $55 per lineal foot.
- Typical curb and gutter section to correct a ponding grade offset is 10 feet, or $550.00.
- Planting a #15 tree with irrigation modification is $250.
- Cost of planting a 24-inch boxed tree with irrigation modification is $450.
- The average cost of an irrigation repair is $193 per site.
- The cost of conversion from turf to mulch and plants were quoted as $4.00 per square foot.
- Street frontages average width is 45' long planting strips of various widths.
- Side frontages on corner houses average of 75' long planting strips at the various widths.
- Turf conversion to mulch - $720 for a 4' wide planting strip to $1,350 for a 7.5' wide planting strip.
- Turf conversion to mulch - $1,200 for a side 4' wide planting strip to $2,250 for a side 7.5'wide planting strip.
- Root prune and install linear root barrier, for 10' - $250.
- Root prune and install linear barrier on 2 sides - $500.
- Tree removal and stump grinding - $480 to $790 depending on tree size, species, and location.

Cost Savings

The cost savings that will result from turf removal alone will generate significant funding for replacing trees that are causing damages. The savings is realized from reduced water costs as well as reduced labor. Low water use plants normally need to be trimmed every 3 to 6 months, versus weekly cutting of lawns.

The savings that result from avoiding repair costs to sidewalks and water lines will also fund much of the replanting and maintenance work for the future by setting the stage for the right trees to grow in the right growing spaces for the desired purpose. This allows annual funds to be shifted to more structural pruning of young trees that is essential in their first 10 years.

Funding

One funding option is to create a capital account for the DV Plan. This would allow the budget to transition across fiscal years, where general fund expenditures usually close out each fiscal year.

The City should examine other options for funding the project, including the potential for gaining additional funds from the County, and M29 assessment district funds.

Photo 4. *Low Water use ground cover in a 4' wide planter strip.*

[5] Cost figures are on 2017 dollars.

ENVIRONMENTAL CONCERNS

The recommendations in this report are meant to achieve a manageable and sustainable long-term canopy in Dougherty Valley. The intent is to maximize the tree canopy in the available planting spaces with reduced conflicts, longer life spans, and optimal benefits the trees.

With the current design, and long-term prognosis is that the trees will:

- not live a normal lifespan,
- cause expensive repairs to infrastructure that have negative environmental consequences based on tree removal, debris, and energy consumption,
- cause many trees to be removed prematurely, and not replaced, due to these conflicts.

The recommendations in the plan are meant to reduce the costly damage and premature removal of the trees as is occurring now. The new trees planted are intended to be grown on the site for up to 40 years or more. This provides a sustainable community tree canopy, not an unpredictable and variable canopy that is constantly subject to premature removals.

One result of removing the turf from the planting strips will be to reduce noise pollution from the constant lawn mowing that is occurring. There will also be less need for blowers that add to the constant background noise of suburban life.

The elements of the plan will be analyzed to determine their impact on the environment, using a California Environment Quality Act review and documentation. This analysis will be accomplished by appropriately trained staff and contractor, and submitted for review.

ADDITIONAL CONSIDERATIONS – WHAT THE FUTURE COULD HOLD

The Consultants recommend that Council consider establishing a City-Wide Tree Committee as a permanent body to advocate for trees and assist with planning

Since such a committee would be considering tree situations citywide, a greater pool of members than just from Dougherty Valley should be recruited to participate. The new Committee should first review the current Tree Ordinance[6], and propose revisions as needed. As the Dougherty Valley Plan is approved, any conflicts or changes necessary to the City's tree ordinances governing public trees should be updated. If the goals for canopy cover, diversity, and tree spacing can be incorporated, it should promote a better long-term tree canopy in both Dougherty Valley and the entire City.

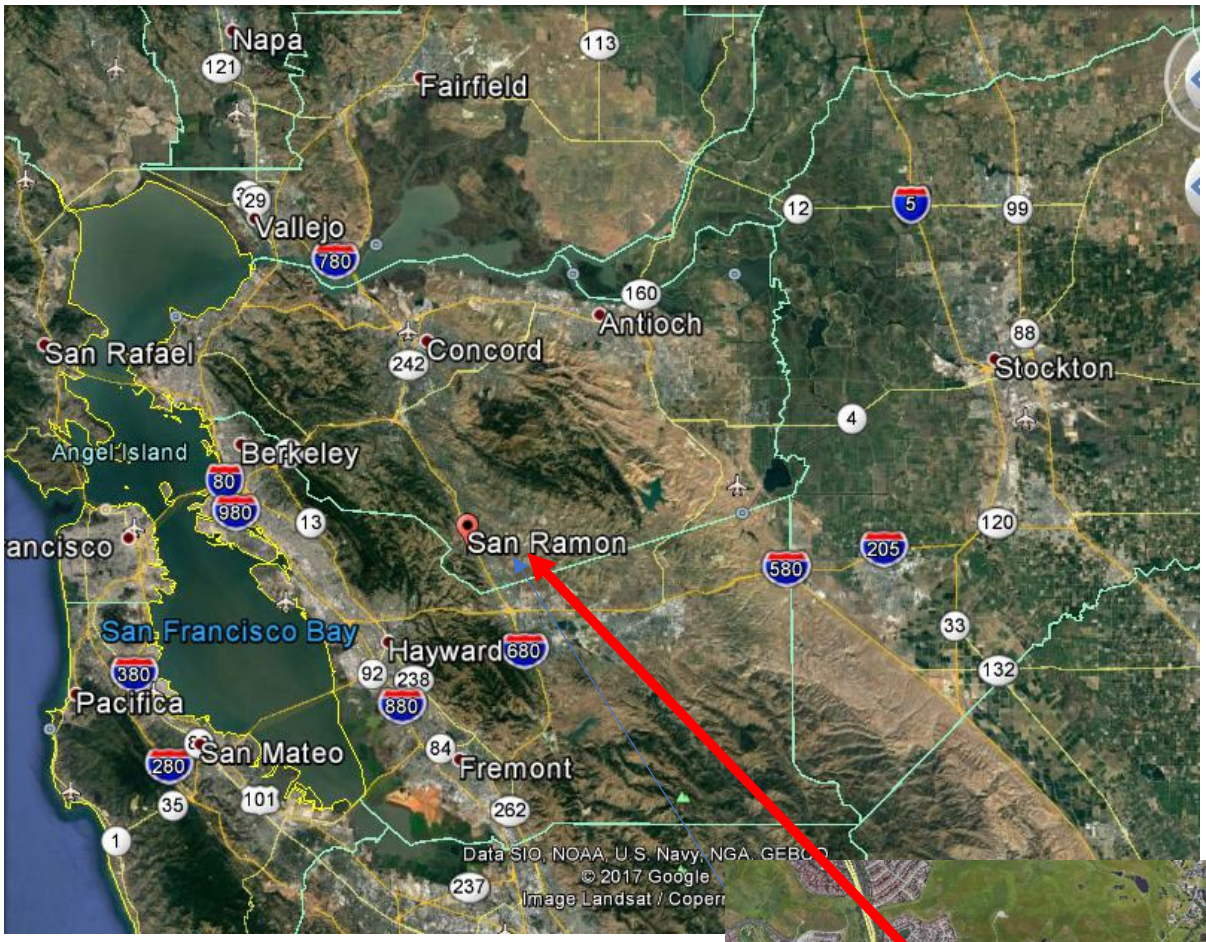
Establish Urban Forestry Position.

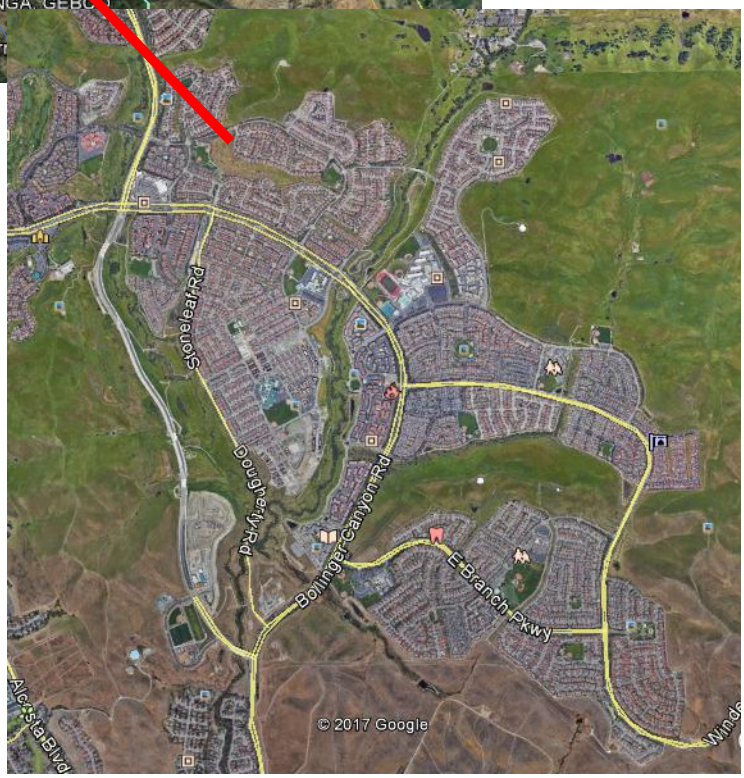
Assign an Urban Forestry Position within the Public Works Department, whose responsibilities would include working with Tree Committee to revise the current Tree Ordinance as needed, develop an Urban Forest Management plan, implement the recommendations included in this Plan for Dougherty Valley and develop annual plans, budgets, and urban forest awareness for the care and management of the City's trees.

[6] San Ramon Code of Ordinances, Chapter IIIA – Community Forestry Program. 4 pages.

APPENDICES

APPENDIX 1 - SITE LOCATION





DOUGHERTY VALLEY

APPENDIX 2 –

DECISION MAKING MATRICES FOR TREE RETENTION, REPLACEMENT OR REMOVAL

		EXISTING DAMAGE		
Type of Damage	**Minor***	**Moderate#**	**Significant@**	**Severe^**
Tree Falling over from Root Barrier	Remove Barrier	Remove Barrier-Stake	Replace Tree	Replace Tree
Surface Rooting	Root Prune	Root prune-Install Barrier	Replace Tree	Replace Tree
Irrigation Heads Blocked	Root Prune	Root Prune	Root prune-Install Barrier	Replace Tree
Water Box Lifted	Root Prune	Root Prune	Root prune-Install Barrier	Replace Tree
Electrical Box Lifted	Root Prune	Root Prune	Root prune-Install Barrier	Replace Tree
Sidewalk Lifted	Root Prune	Root Prune	Replace Sidewalk	Replace Tree
Other Infrastructure Damage	Root Prune	Root prune-Install Barrier	Root prune-Install Barrier	Replace Tree

***Minor** – Tree is damaging only one or two areas, and roots can clearly be pruned to reduce or stop the damage.

#**Moderate** – Roots may be causing irrigation problems, or lifting a utility box, but can be root pruned to avoid future problems.

@**Significant** – Roots are damaging utilities and/or adjacent cement, which will need to be replaced.

^**Severe** – Roots have caused damage to utilities and/or sidewalks and several surface roots are visible that will continue to cause problems.

Any root pruning may result in poor tree stability. Linear root pruning should only take place if the distance from the base of the trunk is 3 times the diameter of the trunk at DBH or greater. Trees that have been root pruned should be checked for stability, and removed if found to be unstable.

	CHARACTERISTICS OF TREE SPECIES			
Extent of Tree Removal Required because of Damage	**Right Size Tree for Site**	**Other Trees Likely to Cause Damage**	**Poor Species**	**Trees too large for site**
1 tree on Block	Root Prune	Replace with New Species	Repair/Remediate	Move/New Sidewalk
2-3 trees adjacent	Repair/Remediate	Repair/Remediate	Repair/Remediate	Move/New Sidewalk
5 trees on one side	Repair/Remediate	Replace with New Species	Replace with New Species	Replace with New Species
7-10 trees on block	Repair/Remediate	Replace with New Species	Replace with New Species	Replace with New Species

	EXPECTED YEARS BEFORE DAMAGE		
SIZE OF TREE	**<6"**	**6"-18"**	**> 18"**
Size of Planting Strip	**Small**	**Medium**	**Large**
Small <4'	25+ years	10 years	5 years
Medium 4-6'	25+ years	15 years	10 years
Large >6'	25+ years	15 years	20 years
Very Large >8'	50+ years	25+ years	25+ years

	TREE IS DAMAGING INFRASTRUCTURE		
SIZE OF TREE	**<6"**	**6"-18"**	**> 18"**
Size of Planting Strip	**Small (4')**	**Medium (5-6')**	**Large (>6')**
Small <4'	Leave tree	Replace tree	Replace tree
Medium 4-6'	Leave tree	Root Prune + Barrier	Replace tree
Large >6'	Leave tree	Root Prune	Root Prune
Very Large >8'	Leave tree	Leave tree	Root Prune

SITE ASSESSMENT TOOL

Name: _____ Address: _____ Date: _____

Phone: _____ Email: _____

Planting Strip Width: ____ Tree Species: _____ DBH: _____ Inspector: _____

Cause of request: Sidewalk Damage: __ Irrigation Damage: __ Curb and Gutter Damage: __

Utilities Damage: __ Other: _____

Assessment Matrix

Site Characteristic	Acceptable	Unacceptable	Retain	Replace
Tree health and appearance				
Tree condition and structure				
Insects or pests present				
Can clearance be achieved for access or line of sight				
Space to continue to grow for 5 years				
Species aligns with DV Guidelines				
Site potential for Alternative Design				
Root pruning will not de-stabilize tree				
Tree Spacing				

Site Characteristic	Remove all	Rectangle	Plants	Irrigation
Turf in planting strip				

Site Characteristic	Same species	New species	Same place	New space
Tree planting				

Root Pruning

Linear root pruning can occur at a distance from the trunk 3 times DBH or greater. If not, tree will need to be removed.

Individual root pruning can occur on up to 2 roots per tree, greater than 2 inches up to 6 inches, on one side at a distance of 2 times the DBH for roots. If not, he tree will need to be removed.

For individual roots larger than 6 inches, one root may be pruned not closer than 3 times DBH if the desire is to try to retain the tree. If stability is a concern, a pull test can be performed. If the tree is deemed unstable it will be removed.

Tree Planting

Is there a better space to plant a tree? If yes, plant a tree in alignment with the DV guidelines, and future spacing goals. Trees can be planted close to existing trees to meet future spacing, with the understanding the existing trees will be removed when the new tree is established.

Site Assessment Considerations

Site longevity: If the tree can be retained on the site without likelihood of recurring sidewalk damage in 10 years, root prune and restore site

Sidewalk design: Can the sidewalk be moved? If yes, move the sidewalk towards the house to create the space for root pruning and site repair. If the site has the space and is a candidate for an alternative material, utilize an alternative material in the sidewalk repair.

Root Pruning: If the space is available to root prune and retain the tree, root prune and install new linear barrier.

Mulch: If planting strip is turf, change turf to mulch at the time of site repair, and modify irrigation for the tree and new landscape plants.

Turf removal and replace with mulch - If reasonable, remove the entire turf from strip and replace mulch and ornamental plants. Only remove turf and replace a mulch rectangle around the tree; modify irrigation for tree.

# of sites: If the site is individual proceed with the individual site work. If a group of sites, confirm the plan for work to address the group.

Crowding: If tree crowns are encroaching and pruning will not resolve the encroachment long term, select the best tree and remove the crowding tree to meet spacing goals. If there is space for continued tree growth without significant damage until the next pruning cycle, continue to grow the tree.

Tree Planting: Is there space to plant a tree? If yes, plant a tree in alignment with the DV guidelines, and future spacing goals. (Trees can be planted close to existing trees to meet future spacing, with the understanding the existing trees will be removed when the new tree is established)

Tree Species
Is the existing species correct for the planting strip space?
Is the species in alignment with the diversity targets?
Is the species in alignment with the DV Guidelines?
If yes to all 3, plant same species.
If not, plant different species.

Bird Nesting
Between February 1 and August 31 of each year (nesting season), conduct a visual inspection for evidence of nesting birds no more than 14 days prior to tree removal. If evidence of nesting is observed, no tree removal activities shall occur within 50 feet of the tree with the nest until the nest is vacated. No visual inspection is required between September 1 and January 31 of each year (non-nesting season).

APPENDIX 3 – SPECIES RECOMMENDATIONS, SPECIES DIVERSITY, AND PLANTING STRIP TREES

Species Recommended for Planting in the Different Sized Planting Strips

Common Name	Scientific Name	Mature size
	3' to 4.5' Wide	***Height by Spread***
Eastern Redbud	*Cercis candensis*	20 x 20
Crabapple cultivars	*Malus species*	20 x 20
Crape Myrtle cultivars	*Lagerstroemia indica*	25 x 20
Flowering Cherry cultivars	*Prunus serrulata*	25 x 25
Forest Pansy Redbud	*Cercis canadensis* 'Forest Pansy'	20 x 25
Japanese Maple cultivars	*Acer palmatum*	20 x 25
	5' to 6.5' Wide	
American Hornbeam	*Carpinus caroliniana*	25 x 20
Chinese Pistache	*Pistacia chinensis*	45 x 30
Chitalpa	*Chitalpa tashkentensis*	25 x 20
European Hornbeam	*Carpinus betulus*	35 x 25
Hedge Maple	*Acer campestre*	30 x 30
Grecian Laurel - Sweetbay	*Laurus nobilis*	30 x 25
Mayten	*Maytenus boaria*	20 x 20
Red Horsechestnut	*Aesculus carnea*	30 x 35
Snowbell	*Styrax japonica*	25 x 20
Sour Gum - Tupelo	*Nyssa sylvatica*	35 x 20
State Street Maple	*Acer miyabel* 'Morton'	45 x 30
Trident Maple	*Acer buegeranum*	20 x 20
	7' to 8' Wide	
Chinese Flame Tree	*Koelreuteria bipannata*	35 x 30
English Oak	*Quercus robur*	50 x 40
Freeman Maple	*Acer freemanii*	50 X 40
Ginkgo	*Ginkgo biloba*	45 x 35
Goldenrain Tree	*Koelreuteria paniculata*	30 x 30
Holly Oak	*Quercus ilex*	35 x 30
Horsechestnut	*Aesculus hippocastanum*	40 x 30
Japanese Pagoda Tree	*Sophora japonica*	35 x 25
Little Leaf Linden	*Tilia cordata*	40 x 35
Marina Madrone	*Arbutus marina*	30 x 25
Pin Oak	*Quercus palustris*	55 x 40
Red Oak	*Quercus rubra*	50 x 45
Red Maple cultivars	*Acer rubrum*	40 x 35
Sycamore Maple	*Acer pseudoplatanus*	40 x 30

Common Name	Scientific Name	Mature size
	8.5' to 16' Wide	***Height by Spread***
Autumnn Purple Ash	*Fraxinus americana* 'Autumn Purple'	45 x 40
Shingle Oak	*Quercus macrocarpa*	50 x 40
Chinkapin oak	*Quercus muehlenbergii*	45 x 45
California Black Walnut	*Juglans hindsii*	80 x 50
California Pepper	*Schinus molle*	50 x 35
Canary Island Pine	*Pinus canariennsis*	60 x 30
Chestnut Leaf Oak	*Quercus castaneafolia*	50 x 40
Coast Live Oak	*Quercus agrifolia*	70 x 50
Cork Oak	*Quercus suber*	50 x 30
Deodar Cedar	*Cedrus deodara*	60 x 40
Evergreen Chinese Elm	*Ulmus parvifolia*	40 x 35
London Plane cultivars	*Platanus hispanica*	50 x 40
River Birch	*Betula nigra*	40 x 35
Dura-Heat Birch	*Betula nigra* 'BNMTF'	40 x 30
Sawtooth Zelkova	*Zelkova serrata*	50 x 40
Soutehrn Live Oak	*Quercus virginiana*	70 x 50
Southern Magnolia	*Magnolia grandifora*	50 x 30
Valley Oak	*Quercus lobata*	80 x 40
Willow Oak	*Quercus phellos*	50 x 35

These growing space recommendations are the minimum site sizes for the species. Some of the trees planted in these minimum sized sites *may*, in optimum growing conditions, become too large for the site, and cause some infrastructure damage, likely in 30 to 50 years.

Trees to Avoid in Future Plantings – Due to disease, insect, frost intolerance or poor performance in Dougherty Valley, we recommend the following species not be planted on Dougherty Valley streets unless proven to perform well in park plantings.

African Sumac (*Rhus lancea)*
Raywood Ash (*Fraxinus uhdei* 'Raywood')
Australian willow (*Geijera parvifolia*)
California Buckeye (*Aesculus californica*)
California Black Oak *(Quercus kelloggii)*
Callery Pears (*Pyrus calleryana*)
Carob (*Ceratonia siliqua*)
Chinese Hackberry (*Celtis chinensis)*
Silver Maple (*Acer saccharinum*)
Hawthorn (Crataegus sp.)
Western Catalpa (*Catalpa speciosa*)
Italian Alder (*Alnus cordata*)
Coast Redwood *(Sequoia sempervirens)*
Monterey pine *(Pinus radiata)*

CURRENT SPECIES IN DOUGHERTY VALLEY[7]

Botanical	Common	# of Trees	Percent of Population
Platanus X hispanica	LONDON PLANE	6082	23.51%
Pyrus calleryana	ORNAMENTAL PEAR	5139	19.86%
Quercus agrifolia	COAST LIVE OAK	2156	8.33%
Celtis sinensis	CHINESE HACKBERRY	1710	6.61%
Pistacia chinensis	CHINESE PISTACHE	1126	4.35%
Prunus cerasifera	PURPLE-LEAF PLUM	1100	4.25%
Pyrus spp.	FLOWERING PEAR	935	3.61%
Prunus blireiana	FLOWERING PLUM	797	3.08%
Quercus lobata	VALLEY OAK	688	2.66%
Sequoia sempervirens	COAST REDWOOD	678	2.62%
Quercus virginiana	SOUTHERN LIVE OAK	639	2.47%
Ulmus parvifolia	CHINESE ELM	497	1.92%
Lagerstroemia indica	CRAPE MYRTLE	476	1.84%
Zelkova serrata	SAWTOOTH ZELKOVA	454	1.75%
Fraxinus angustifolia oxycarpa	RAYWOOD ASH	438	1.69%
Pinus pinea	ITALIAN STONE PINE	436	1.69%
Malus floribunda	CRABAPPLE	346	1.34%
Crataegus laevigata	ENGLISH HAWTHORN	225	0.87%
Crataegus spp.	HAWTHORN	191	0.74%
Crataegus phaenopyrum	WASHINGTON THORN	182	0.70%
Fraxinus spp.	ASH	168	0.65%
Schinus molle	CALIFORNIA PEPPER	147	0.57%
Cercis canadensis	EASTERN REDBUD	109	0.42%
Arbutus unedo	STRAWBERRY TREE	98	0.38%
Acer buergeranum	TRIDENT MAPLE	73	0.28%
Arbutus 'Marina'	MARINA ARBUTUS	73	0.28%
Photinia fraseri	FRASERS PHOTINIA	66	0.26%
Aesculus californica	CALIFORNIA BUCKEYE	61	0.24%
Chitalpa tashkentensis	CHITALPA	59	0.23%
Umbellularia californica	CALIFORNIA BAY	57	0.22%

[7] Personal Communication, Jason Pinegar of West Coast Arborists. This information is from the tree inventory for Dougherty Valley.

Botanical	Common	# of Trees	Percent of Population
Rhus lancea	AFRICAN SUMAC	57	0.22%
Cedrus deodara	DEODAR CEDAR	55	0.21%
Afrocarpus nagi	NAGI AFROCARPUS	49	0.19%
Celtis australis	EUROPEAN HACKBERRY	49	0.19%
Cercis spp.	REDBUD	49	0.19%
Cornus stolonifera	RED TWIG DOGWOOD	47	0.18%
Fraxinus americana 'Autumn Purple'	AUTUMN PURPLE ASH	44	0.17%
Lagerstroemia indica 'Muskogee'	MUSKOGEE CRAPE MYRTLE	38	0.15%
Pinus radiata	MONTEREY PINE	23	0.09%
Ginkgo biloba	MAIDENHAIR TREE	20	0.08%
Prunus persica 'Nucipersica'	NECTARINE	19	0.07%
Arbutus spp.	ARBUTUS	17	0.07%
Pyrus kawakamii	EVERGREEN PEAR	13	0.05%
Olea europaea	OLIVE	13	0.05%
Liriodendron tulipifera	TULIP TREE	13	0.05%
Juglans nigra	BLACK WALNUT	12	0.05%
Fraxinus americana	WHITE ASH	11	0.04%
Maytenus boaria	MAYTEN TREE	10	0.04%
Malus spp. & cv.	APPLE	10	0.04%
Platanus racemosa	CALIFORNIA SYCAMORE	8	0.03%
Quercus suber	CORK OAK	5	0.02%
Populus fremontii	FREMONT COTTONWOOD	5	0.02%
Salix nigra	BLACK WILLOW	5	0.02%
Various	Less than 5 trees per species	11	0.02%
		25,871 Total trees	

STREETS WITH 7' WIDE PLANTING STRIPS (MOSTLY ON COLLECTOR STREETS)

Type of Planting Strip	Street Name	Predominant Tree Species	Trunk Diameter Range	Width of Planting Strip
Front	BLUEHEART WY	LONDON PLANE	07-12	7
Front	BOWLIN AV	COAST LIVE OAK	0-6	7
Median	BOWLIN AV	PURPLE-LEAF PLUM	0-6	7
Slope	BOWLIN AV	ARBUTUS	0-6	7
Front	CINNAMON RIDGE RD	ORNAMENTAL PEAR	0-6	7
Side	CINNAMON RIDGE RD	ORNAMENTAL PEAR	0-6	7
Front	BROWNTAIL WY	LONDON PLANE	0-6	7
Side	ZABRINA CT	LONDON PLANE	07-12	7
Front	CALICO CT	RAYWOOD ASH	07-12	7
Front	EAST BRANCH PKWY	ORNAMENTAL PEAR	07-12	7
Front	GALE RIDGE RD /N	ORNAMENTAL PEAR	0-6	7
Side	CALICO CT	RAYWOOD ASH	07-12	7
Front	HARCOURT WY	CHINESE HACKBERRY	07-12	7
Front	IVY HILL WY	ORNAMENTAL PEAR	07-12	7
Front	JAPONICA WY	LONDON PLANE	07-12	7
Front	MAIDENHAIR CT	LONDON PLANE	07-12	7
Side	ZABRINA WY	LONDON PLANE	07-12	7
Front	MAIDENHAIR WY	LONDON PLANE	07-12	7
Side	BLUEHEART WY	LONDON PLANE	13-18	7
Front	MONARCH RD /S	LONDON PLANE	0-6	7
Front	SHERWOOD WY	ORNAMENTAL PEAR	07-12	7
Front	SNAPDRAGON DR	RAYWOOD ASH	0-6	7
Side	CALICO DR	RAYWOOD ASH	07-12	7
Side	CALICO CT	RAYWOOD ASH	07-12	7
Front	WINDEMERE PKWY	ORNAMENTAL PEAR	07-12	7
Front	ZABRINA CT	LONDON PLANE	07-12	7
Front	ZABRINA WY	LONDON PLANE	07-12	7

NUMBER OF TREES IN PLANTING STRIPS BY SIZE AND SPECIES

Strip Width	Species	# of Trees
4’	Chinese Hackberry	472
4’	Chinese Pistache	35
4’	Crabapple	21
4’	Fraser’s Photinia	13
4’	Hawthorn	4
4’	Italian Stone Pine	4
4’	London Plane	1499
4’	Muskogee Crape Myrtle	37
4’	Ornamental Pear	911
4’	Raywood Ash	75
4’	Southern Live oak	80
4’	Strawberry tree	60
4’	Trident Maple	58
4’	Stump	23
4’	Vacant site	491

Strip Width	Species	# of Trees
5’	Chinese Hackberry	234
5’	Chinese Pistache	295
5’	Coast Live oak	8
5’	Crabapple	103
5’	Crape Myrtle	79
5’	European Hackberry	49
5’	Hawthorn	53
5’	London Plane	1904
5’	Monterey pine	23
5’	Nagi Afrocarpus (broadleaf podocarpus)	21
5’	Ornamental Pear	453
5’	Purple-Leaf Plum	68
5’	Raywood Ash	121
5’	Red Maple	3
5’	Southern Live oak	8
5’	Trident Maple	12
5’	Sawtooth Zelkova	227
5’	Stump	25
5’	Vacant site	346

Strip Width	Species	# of Trees
6’	African Sumac	15
6’	Bronze Loquat	1
6’	California Pepper	4
6’	Chinese Elm	26
6’	Chinese Hackberry	472
6’	Chinese Pistache	95
6’	Coast Live oak	105
6’	Coast Redwood	71
6’	Cork oak	5
6’	Crabapple	74
6’	Crape Myrtle	15
6’	Deodar Cedar	9
6’	Eucalyptus	14
6’	Fraser’s Photinia	21
6’	Italian Cypress	4
6’	Italian Stone pine	36
6’	Hawthorn	35
6’	London Plane	771
6’	Maidenhair tree	20
6’	Marina Arbutus	39
6’	Nectarine	19
6’	Ornamental Pear	674
6’	Purple-Leaf Plum	30
6’	Raywood Ash	40
6’	Sawtooth Zelkova	204
6’	Valley oak	43
6’	Willow	2
6’	Stump	19
6’	Vacant site	156

For species diversity goals, to only have 10% of a species, at least 10 different species are necessary. There are more than 10 species, but most are currently a small percentage of the population, while two species make up 43% of the population. We have found that greater diversity can be a benefit and offer the **Species Recommended for Planting in the Different Sized Planting Strips** for consideration.

APPENDIX 4 - PLAN METHODOLIGY

Field Assessments

The consultants made 4 different tours of the site to analyze what the landscape and growing conditions are, what has been done to address the situations to date, and develop recommendations as to how best to resolve the situation in both the short term and the long term.

Consultants Denice Britton and Gordon Mann visited several sites in the development prior to the first meeting with the City, including a site that was still under construction. We took part in the planned tour of the sites with the Committee members, and listened to their concerns, responses and ideas about resolutions and resistance to those resolutions.

Public works staff, areas who work day to day with the situation, took us on a tour where we learned of their challenges, the approaches they have taken and their concerns about escalation of the damages and the numbers of repairs they are experiencing.

The consultants took a final tour alone to discuss and examine conditions along arterial and collector streets, as well as local streets, to take an objective look at the problems, issues and potential impacts of the various solutions presented.

A copy of the West Coast Arborists Tree Inventory Data for Dougherty Valley was used as a resource to determine the actual species composition and the size of the planting strips along various streets.

The scope of work did not include the time to perform a block by block analysis of the entire area, and as a result a street by street recommendation is not included in the plan. The over-riding screening criteria became the planting strip size and age of the sites regardless of tree species or landscape plants present.

Tree Committee Discussions

The discussions with the Tree Committee revealed several misconceptions about what the community was supposed to look like, according to the Specific Plan and the approved development guidelines. In the study of documents provided, it became apparent that the Community was well planned, as presented in the *Community Design Handbook*[8], but the actual built project did not follow those Guidelines. The Committee voted on several options regarding their recommendations to the consultant. The one that most of the Committee felt strongly about was to specifically “follow the Plan” for the project.

The Committee was in general agreement on these other discussion points:

- Use the right size species for the size of the planting strip
- Provide appropriate spacing for trees
- Plant replacement trees farther from utilities to reduce conflicts
- Reduce or eliminate lawns in planting strips
- Improve irrigation systems – use drip techline or emitters, and not spray heads

The Tree Committee was split on whether trees along a neighborhood block should be more than one species. Most Committee members found it acceptable to have 2 species on a neighborhood street, especially if the trees were being transitioned from the existing species to a new species. Committee members wanted consistent planting. No one seemed comfortable planting more than 2 species on a block.

[8] Dougherty Valley Community Design Handbook, October 1992. Contra Costa County. PBR

The Committee asked that we develop a Maintenance Plan over time, so as not to make drastic changes all at once. We discussed that such a plan would look like the following:

- Retain trees that are not causing significant damage if possible
- Root prune those trees to remove most damaging roots
- Consider moving the sidewalk over to make more room when needed and if possible
- Change materials used for the sidewalks to reduce root cutting and recurring damage as appropriate
- Consider Tree Removal as the last resort, based on specific criteria
- Use similar species characteristics when using more than one species on a street

BACKGROUND INFORMATION

The project challenged us to mitigate community conditions that have flaws. No one we consulted with wants to see trees removed in the Dougherty Valley neighborhoods. However, they understand that the trees were planted in less than optimal conditions that included:

- too narrow planting strips and crowded spacing for the species used,
- poor soil structure and fertility; and
- poor planting practices.

This limited growing space and other conditions has resulted in conflicts that have high repair costs, and will require trees to be removed before they reach mature age.

Dougherty Valley Specific Plan

The Dougherty Valley Specific Plan[9] sets forth a far-sighted vision for a growing community that meets the challenges of the site and design constraints, and contains the opportunities for improving the long-term community tree canopy. The Specific Plan document and related guidelines provide for the development of Dougherty Valley's trees and planting strips, as a refinement to the Contra Costa County General Plan.

The community, as defined in the Plan, has been developed from 3 historic pieces of land, the Shapell Industries Site (2,708 Acres), Windemere BLC (2,320 Acres), and Camp Parks Military Reserve (950 Acres)[10]. These areas have been assigned a multitude of uses including City Center, Community College, parks, open space and residential neighborhoods of varying densities. This report focuses primarily on the neighborhoods, and includes the streetscapes that are intended to provide a large portion of the ecological amenities of the built environment for the community. These neighborhoods encompass a total of 1,932.3 acres[11], excluding the Village Center.

The Plan and our analysis further breaks down the streets into three categories:

- Arterials with 8' to 16' wide planting strips and medians (Figures 6-3 to 6-5)
- Collector Streets with 7' to 8' wide planting strips (Figures 6-5 to 6-6) and
- Local Streets with 3.5' to 6' wide planting strips (Figures 6-7 to 6-9)

It is the local, residential streets that have experienced the most conflicts and were the primary attention of the Citizen's Tree Committee.

[9] Dougherty Valley Specific Plan (DVSP), Contra Costa County, Amended and Approved by the Board of Supervisors, Feb 11, 2014.
[10] DVSP, Figure 3-4.
[11] DVSP, Page 4-6

APPENDIX 5 – EXISTING CONDITIONS

Arterial Streets

The basic design intent of the arterials was to contain landscapes with significant sized trees that could provide an almost forested appearance with time. Arterial streets have large center medians containing at least double rows of larger trees plus smaller species at each end and alongside some of the larger trees. An occasional narrower Median can be found in some of the steeper sections of road, such as on Bollinger Canyon.

These medians are flanked by wide parkstrips, sidewalks and sloping landscapes. In some medians the species is consistent, but for the most part, the species vary greatly from one block to another. For example, the tree selection may also change within the block from live oak to pistache or plums or crape myrtle. Some long flat areas were planted in large expanses of purple-leaf plums. There were two different varieties used and one is not performing well. In many areas, the number of trees of one species presents a risk of high tree loss if an insect or disease or insect, such as Dutch Elm Disease or Emerald Ash Borer, attacks a specific species or genus.

Photo 6. *Bollinger Canyon Road median, containing London Plane trees with adequate growing space. The trees are healthy and growing vigorously. The under planting has recently been replaced.*

The Dougherty Valley Tree Inventory[12] identified 59 medians, slopes or parkstrips that are wider than 10'. Most of the trees are doing well, with the notable exception of the plums. A few dead trees can be found in many medians. Landscape successes are inconsistent, especially after the drought. Many of the landscapes are in the process of being renovated with plant replacements because of conversions to reclaimed water,

[12] West Coast Arborists (WCA) have been contract pruning the tree in Dougherty Valley and San Ramon for several years. Their database of the current tree inventory was provided to the consultants for this project.

water conservation and testing new plant materials as an alternative to turf. There are few remaining medians along the arterials that include turf. The more turf that is replaced, the more water savings and maintenance savings will be experienced.

Collector Streets

The *Community Design Handbook* states the following about the Collector streets:

"Collectors will not have medians…. Tree planting strips shall contain trees at 30' intervals with groundcover between them. Each collector shall have one primary dominant type of tree…to provide lower broader, leafy canopies with ample vegetation under 50 feet in height. This is intended to create a more sheltered pedestrian route…"

The Collectors were intended to have one or two sides of the streets with traditional planting strips 6' to 7' wide, with additional planting areas between the sidewalk and sound walls that were to be 8' wide. In some areas, the space between the walls and the sidewalk is too narrow for trees, and trees were planted anyway. In other areas, the "standard Collector" was to not have landscaping behind the sidewalk, as the planting strips were intended to be 7' wide.

The collector streets were planted with limited species diversity, containing only a few tree species, and two species make up almost 2/3rds of the population: 40% are London Plane and 25% are Ornamental Pears. The pear trees should provide a long-term tree canopy in 7' wide planting strips. The London Plane trees were recommended to be planted where the planting strips are at least 12' wide. Those planted in smaller planting strips will not provide long term canopy without infrastructure conflicts and additional maintenance expense.

Photo 7. *Ornamental Pears growing in a 7' wide planter strip along Bollinger Canyon Road.*

Local Streets

Local streets are residential, and were intended to be planted with smaller trees to shade sidewalks and provide aesthetic appeal. As a result, the planting strips were designed smaller, from 3.5 feet to 6 feet wide. Larger size tree species were planted in these narrow planting strips. It has been common for new developments to choose a fast-growing species and overplant for a more instant appearing landscape. During development, the soil was compacted, with little soil remediation or tilling in the planting strip taking place before planting. Circular root barriers were used around the larger trees in narrow planting strips to address the limited planting area and attempt to control the natural root growth of the larger trees. However, the barriers were not successful in most cases, and large diameter roots have grown over the barriers and on the surface.

The placement and spacing of trees was inconsistent, with some streets being clearly over-planted – trees placed on 20' centers, while other streets were more logically planted with trees placed on 30' to 40' centers. Where wider bulb-outs were created, trees were not planted in the larger areas. There was no apparent concern for the proximity of utilities, street lights, and concrete improvements to the tree planting locations.

Table 2, below, shows the numbers of trees planted in the narrower 4-foot wide, 5-foot wide, and 6-foot wide planting strips. These narrower strips are not recommended in the DV guidelines and accepted horticultural practice for larger scale trees due to the likely infrastructure damage, and the potential for premature removal of the trees. The three trees of the greatest quantity are London Plane (4,174), Ornamental Pear (2,038), and Chinese Hackberry (1,178). Other large-scale trees too large for narrow planting strips included: Sawtooth Zelkova (431), Raywood Ash (236), Coast Live Oak (113), Southern Live Oak (88), Redwood (71), European Hackberry (49), Valley Oak (43), Italian Stone Pine (40), Evergreen Chinese Elm (26), Monterey Pine (23), Deodar Cedar (9), Cork Oak (5), and Red Maple (3).

In summary, a total of 8,526 larger sized trees and 1,247 medium to smaller sized trees were planted in the 4, 5, and 6-foot-wide planting strips. This ratio of tree plantings highlights the extent of the potential problem given that only 13% medium to smaller sized trees were planted in the appropriate planting strip width.

The Development Process

The main challenge the City of San Ramon has experienced with the Dougherty Valley landscape maintenance is the large number of trees causing infrastructure damage and the resulting disruption of the growth of the expected canopy over City streets.

Every location where a larger tree than provided by the guidelines was planted in a limited size planting space will likely result in additional City maintenance costs for irrigation and hardscape repairs. Because the trees cannot grow to maturity, the growth of an extensive canopy will be delayed.

Trees Species

In residential areas, London plane is performing well in many locations, and not as well in other locations. We found at least 2 different varieties, Columbia and Bloodgood, while some trees were unknown varieties. The canopies of the trees were quite inconsistent. In most locations, the surface roots were overtaking the planting strip and utilities. Observed roots were found to be 4" to 8" in diameter on 6" to 8" diameter trees. Roots that grew over the circular barriers are much greater width than unconstrained growing roots.

The Ash trees plantings are universally taking up the entire planting strips and have completely inundated the available growing space with roots. The two most common varieties were Raywood and Autumn purple ash.

Unfortunately, both varieties are grown on ash root stock that have large diameter roots that have inundated the planting strips, and are also growing into the adjacent yards.

Pears have their own unique issues. The roots are generally not as aggressive as some of the other species, but the trees tend to be stunted, have extensive dieback, and in some cases, are beginning to get Fire Blight disease *(Erwinia amylovora*). In addition, they tend toward poor branch structure, with upright, tight branch attachments with included bark; and were often planted too close together. On streets that are being irrigated with recycled water, they are as much as double the size of those growing on potable water. The reasons could be a combination of cut back for the drought and more nutrients in the water.

African sumac trees are not growing well, nor were the few Podocarpus trees we observed. They appeared anemic and had very slow growth.

Crape myrtle and Trident Maple are being planted as replacement trees in the areas where the original trees were causing damage to utilities and sidewalks. Muskogee Crepe myrtle *(Lagerstroemia indica x fauriei* 'Muskogee') has been used almost exclusively, creating more limited diversity in the tree population.

Trident maple *(Acer buergeranum)* is a medium sized tree that is doing fairly well in the locations it has been planted to replace trees causing infrastructure damage. Its mature size is noted as 25' tall and 25' wide, so it should do well long-term in the smaller planting strips.

Ground covers

Most of the planting strips were originally planted with turf grass for ground cover. On some blocks, other ground covers have been planted; most commonly to Asian jasmine *(Trachelospermum asiaticum*), coprosma (*Coprosma Kirkii*) prostrate juniper *(Juniperus horizontalis*), Wintercreeper (*Euonymus fortunei*), and Lowfast Cotoneaster (*Cotoneaster dammeri* 'Lowfast'). Of these the Asian jasmine is consistently in good shape, cotoneaster performs well if irrigation is consistent, and the others are fair to good performers. There are opportunities to add more ground cover species to the list. Coordination with a landscape architect will support using the correct ground covers for the available sites. All require consistent irrigation for good performance, although water use will be approximately half the quantity required for turf.

In several areas, the turf grass was observed to be brown, or trees have been replaced with wood chip mulch. In these cases, the irrigation has been shut off because of breaks in the lines from tree roots. While requests have been to remove the trees, the City has been delaying further removal and replacement in anticipation of the decisions to be made from this study and the Citizen's Tree Committee's recommendations.

New Plantings Installed

In those areas where new trees have been planted, we did not observe the surface rooting so prevalent in the original plantings. This is likely due to the trees being younger and smaller in size, although some of the older replacements are beginning to approach the size of the younger trees in parts of the development. A reason for reduced surface roots could be improved planting quality with city staff taking the time to spread out the roots, and dig wider holes following industry guidelines. Another possibility is the combination of stump and surface root grinding and excavation tilled the soil where the trees were planted.

Species Selection

One area of discussion with the committee was the choice of tree species. We listened to their preference for certain trees, and as previously stated, there was committee agreement to follow the community design plan and DV Community Design Handbook. It is clear the selection of tree species planted during the construction work was different than the species descriptions in the guidelines. The list below shows the trees in the DV

Community Design Handbook. The main reason tree species are sorted by planting area size is their expected size at maturity. The planting space width is the minimum space the trees need to grow to their mature size. Tree species should not be planted in spaces less than the minimum size planting strip. If the growing space is too small, the trees will displace the adjacent infrastructure.

Table 3. Species Recommended by the Original Guidelines Based on Planter Strip Widths

3'- 4.5' Wide Planting Strip	5'- 6.5'	7'- 8'	8.5'- 16'
Eastern Redbud	Trident Maple	Japanese Pagoda Tree	Silver Maple
Chitalpa	Japanese Maple	Goldenrain Tree	California Buckeye
Crepe Myrtle	Red Maple	Holly oak	Marina Arbutus
Flowering Cherry	Red Horsechestnut	Pin oak	White birch
Callery Pears	Forest Pansy Redbud	English oak	Deodar cedar
	Hawthorn	Red oak	Chinese Hackberry
	Chinese pistache	African Sumac	California Black Walnut
	European Hornbeam		Southern Magnolia
	Sweetbay-Grecian Laurel		Chinese Elm
	Sour gum (Tupelo gum)		Chinese Flame tree
	Western Catalpa		London Plane
	Italian Alder		Coast Live oak
	Australian willow		California Black Oak
	Carob		Valley oak
	Ash species		Cork Oak
			Southern Live oak
			California Pepper
			Zelkova
			Canary Island pine

Species Diversity

A major tenet of Urban Forestry is species diversity. Diversity is important because most insect and disease complications are species specific. While there are some insects and diseases that bridge a Genus or even attack several Genuses, that is rare in the current urban tree growth experiences. A long-standing diversity goal developed by the National Arboretum is to target having no more than 10% of any species, 20% of any Genus, and 30% of any Family in the plant biological kingdom. The population of Dougherty Valley trees has two species that exceed those targets - London Plane at almost 24%, and Ornamental Pear at almost 20%. Table 3 shows the species diversity of the tree population growing in Dougherty Valley.

The Existing Plan as the Basis for Recommendations.

The Committee agreed that sticking to the plan and following the guidelines were high priorities.

The Community Design Handbook provides for the following, which were not adhered to:

1. Long, narrow strips of turfgrass such as traffic medians and between the curb and sidewalk are not permitted.
2. Soil tests shall be required to determine type of soil, soil structure and water holding capacity and fertility. Soil is to be amended according to report recommendations

The Landscape Standards within the current Zoning Ordinance for San Ramon recognizes the problems associated with planting large trees in small spaces. These call for specific items that were not followed in Dougherty Valley:

1. Landscaped planter areas shall have a minimum inside width of five feet where trees are provided and four feet where turf or shrubs are provided;
2. Trees planted near public sidewalks or curbs shall be of a species and maintained in a manner which prevents physical damage to the curbs, gutters, sidewalks, and other public improvements;
3. Ground cover shall be of live plant material. Bark, colored rock, gravel, and similar materials may be used in combination with a living ground cover. Non-plant materials may be approved for use in limited areas by the Zoning Administrator.

Once the sites are annexed into the City, the City's Public Works Department becomes the authority to approve changes to the design. This plan will guide the Public Works Department in their work moving forward.

Planting Strips, Compacted Soils and Turf

Research and practice by horticultural and arboricultural professionals has shown that lawns and trees don't mix well.[13] During the construction process, the soil left in planting strips is substandard for growing trees. It has been cut down on the road side, and compacted in the process by the equipment to install the roads, utilities and sidewalks. Utility lines (also surrounded by sand resulting in areas of poor drainage), house foundations, curb and gutter, and sidewalks are installed a few feet away. It has been found that the contractors are putting or leaving leftover cement, sand, and gravel in the planting strips.

Even though landscape plans (and the DV Planting Guidelines)[14] almost always call for the soil to be left clean, amended according to soils tests, and tilled to alleviate compaction; the specification appears to be regularly ignored by all parties, including the developers, the contractors, the landscapers, and building inspectors.

The trees are usually one of the last installations of the projects. The holes are often dug too deep and soil placed back in that will settle, the trees are pulled out of their pots and stuck in the ground without proper root pruning and root straightening, cement chunks and debris are left in the planting strips, and lawn is neatly laid over the soil – smoothing over the contents below.

Unfortunately, the homebuyers and the City are the recipients of the potential long-term impacts of these planting practices. The consequences of the situation have begun to appear 6 to 10 years later, and the conflicts and damages will only increase over the next 15 to 20 years.

The trees usually survive despite their poor treatment, and begin to shade the streets as promised. But the compacted soils and turf irrigation encourage roots that are shallow. These roots are near or on the soil surface that is kept moist to 4" to 6" for the lawn; growing alongside the pipes where water and air are more available, and under the sidewalks which condense moisture. Eventually, these roots grow into the irrigated yards. Because the tree roots disrupt the utilities and displace concrete, complaints are received, and the need for expensive repairs increase.

[13] Green, Thomas L. and Gary W. Watson. 1989. Effects of Turfgrass and Mulch on the Establishment and Growth of Bare-root Sugar Maples. *J. of Arboriculture* 15(11): 268-276.

[14] Dougherty Valley Community Design Handbook, October 1992. Contra Costa County.

Trees and Utilities

Most site installations did not include adequate space between trees and utilities. In some situations utilities were placed in locations apparently designed for trees such as bulb-outs. Trees were planted too close to utilities to allow for a utility line or fixture to be repaired without having to remove the tree.

Photo 8. *Trees planted in Dougherty Valley in the spring of 2017. The soils are compacted and construction debris is present.*

The trees are too often included in the projects as an amenity without long term maintenance considerations. At first, the Public Works department is kept busy keeping things green and attractive. As the trees grow larger, they begin breaking apart the neat tidy, planting strips, sidewalks, and in many cases front yards. An unintended result is that property owners often do not want trees replanted because they are wary of the recurring damages.

The option and recommendation for removing turf in the turf strips and changing them to planting strips was discussed with the Citizen's Tree Committee and initially met with some resistance - partly due to aesthetics; but also, partly due to a commitment to what they thought was the original design. However, support to replace the turf was achieved once our research and committee discussions revealed that the Community Design Handbook specifically stated that "Long, narrow strips of turfgrass such as traffic medians and between the curb and sidewalk **are not permitted.**"[15]

Also supporting the turf conversion, the State of California now has requirements[16] that landscapes installed or renovated after 2009 cannot have the above ground spray heads that result in water running down the street rather than percolating into the soil for the roots. These regulations state that every urban area must reduce their water usage by 20% as of 2020. All these facts, further support that the turf grass should be replaced with drought tolerant plants and retrofitted irrigation systems.

The cost for converting turf to shrubs, can be as much as $4.00 per square foot. The cost to only install mulch would be less. The appearance of only mulch would likely be much less desirable for most homeowners. The State of California Department of water resources and some water agencies have been providing grants to reduce lawns, and may continue to do so in the future. We recommend this be considered and investigated as a potential funding source for future projects.

[15] Dougherty Valley Community Design Handbook, October 1992. Contra Costa County., page 39.

[16] California Senate Bill X7-7 was enacted in November 2009, requiring all water suppliers to increase water use efficiency.

The change from turf to mulch covered areas would benefit from placing stepping stones or walking steps or modular pathways across the planting strip to guide pedestrians, and improve the long-term traffic across the planting strips. Several options for walkways can be offered and selected by HOA or homeowner preference as the City works with different neighborhoods for implementation.

Citizen Requests

The City of San Ramon has a messaging system to allow citizens to request service regarding tree issues in Dougherty Valley. We were shown the current list of 132 requests, which shows the extent of the damages present at the time of the request. The requests fell into the following areas of concern (there are 139 requests because some complaints contained multiple issues):

- Surface Roots 32
- Damage to water lines 31
- Irrigation breaks or leaks 26
- Sidewalk damage 17
- Replace tree that was removed 15
- Tree is dead or dying 6
- Tree is leaning, may fall 6
- Leaves are a problem 3
- Tree is too big 2
- Allergy to leaves 1

Summary

In summary, the roots of trees planted in Dougherty Valley residential areas are overpowering the planting strips, and causing extensive damage to irrigation lines and utility boxes and are beginning to disrupt sidewalks, curbs and even private property. The overarching reason for having a Citizen's Tree Committee work with the Consultants is to identify and confirm the elements of the problem, come up with alternative solutions and develop an action plan that the citizens will deem acceptable. The goal is to find a sustainable solution that retains a canopy of trees in residential areas while reducing both the costs and the inconvenience of infrastructure damage.

Photo 7. *An ash tree that has inundated the planting strip, broken the irrigation and is clearly too large for the space allotted.*

APPENDIX 6 – BENEFIT VALUES OF TREES

The question was raised by the committee on whether the benefits and services the trees provide is real, and when do they make sense for the community. We researched the i-tree program and the USFS data for Northern California.[17]

The benefits calculated for trees only include energy saving, air pollution reduction, carbon sequestration, and storm water interception. The figures are for a representative small tree, medium tree, large tree, and large conifer tree growing in a public space (planting strip) and calculated for net benefits at year 10, year 20, year 25, year 30, year 40, and the 40-year average. The last column is when the benefits surpass the 40-year average. The models are based on measuring and modeling hundreds of trees in 16 different climate zones across the US. This zone is the coastal zone and trees were measured and modeled in Berkeley.

Total Annual Tree Benefits Over Time

Tree Size	Year 10	Year 20	Year 25	Year 30	Year 40	40 Yr Ave	Yr surpass Ave
Small	$20.84	$29.44	$51.71	$62.38	$81.85	$46.67	25
Medium	$52.70	$68.35	$73.42	$75.60	$78.88	$65.59	20
Large	$96.59	$120.83	$134.15	$147.31	$171.66	$129.20	25
Large Conifer	$156.76	$175.87	$182.68	$190.77	$201.06	$175.59	20

The 40-year average was used to determine when the tree is maximizing positive benefits for the community. In all models, the trees continue to provide greater benefits as they grow larger. The pages are available in Appendix 2 of the Northern California Coast Community Tree Guide Benefits, Costs, and Strategic Planning. The guide is available at: https://www.itreetools.org/streets/resources/Streets_CTG/PSW_GTR228_Northern_California_Coast_CTG.pdf

Based on the benefits findings, planting trees that can grow for at least 25 years or more without causing significant expensive infrastructure repairs will grow a sustainable tree canopy in Dougherty Valley. The definition of sustainable used for this determination is that for every dollar invested in the tree population, San Ramon receives at least one dollar or more back in net benefits.

While it is possible to grow trees on a 20-year cycle and achieve some shade, if there is associated infrastructure damage, those costs aren't sustainable. A better long-term plan is to grow the trees that the site was designed for, a smaller scale canopy that can grow for more than 25 years without significant infrastructure conflicts.

Another action discussed in the committee is to re-design the growing space by moving the sidewalk towards the houses, and/or use a thinner modular alternative material for the sidewalks which should increase the length of time the larger trees can grow in the site. There is a cost to the re-design. If the trees can be root pruned and retained, the saving of tree removal and replacement costs and retaining the larger canopy are a more sustainable approach.

The committee's request for planning and review can be accomplished by starting with the service requests on hold and creating the plans to address the situations discussed by the Committee. As those sites are addressed, the costs, tree species choices, and turf transitions will be completed and then reviewed.

[17] April 2010. E. Gregory McPherson, James R, Simpson, Paula J. Pepper, Aaron M. N. Crowell, and Qingfu Xiao., *Northern California Coast Community Tree Guide: Benefits, Costs and Strategic Planning*, USDA Forest Service Pacific Southwest Research Station, PSW-GTR-228, pgs. 92-101.

APPENDIX 7 – PLANTING AND NURSERY STOCK SPECIFICATIONS

Tree Planting Specifications

Trees shall be free of major injury such as scrapes that remove greater than 20% of the bark circumference, a broken central leader, or constrictions from staking or support. The graft, if present, shall be consistent for the production of the cultivar or species. The trunk flare shall be at grade, not buried by soil, and adventitious roots shall not be growing from above the trunk flare.

The tree shall not be root bound in the container, and the trunk diameter relative to the container sizes, within the limits of American National Standards Institute (ANSI) Z-60 Nursery Standards.

Prior to acceptance, upon delivery, sample trees shall be pulled from their container, so the root ball can be inspected for compliance with the specifications. An agreed upon maximum percent of trees should be checked for compliance. The nursery should provide post-delivery care specifications to keep the trees in optimum condition until planting.

Tree Planting

1.0 INSPECT THE TREE

1.1 Carefully remove the soil at the top of the container to locate the trunk flare. Check for girdling roots and damage to the root system and lower trunk.

1.2 Until a relationship is established with the supplying nursery, randomly select an acceptable sample for the delivery. Inspect the root system by taking the root ball out of the container, and remove all the soil from the root system. Inspect the inner roots to verify that the roots were properly pruned when moved from the initial container to the next larger size. Keep the root system moist during the check. If the roots were properly pruned during container transfer, and the roots have been kept moist, the tree can be planted as a bare root tree.

1.3 If the trees are acceptable, each tree shall be removed from the container prior to digging the hole, and the depth of the root ball from the trunk flare to the bottom of the root ball shall be measured. This measurement, less 1” is the depth the pedestal in the center of the planting hole shall be excavated to.

2.0 DIG THE HOLE

2.1 Shave and discard grass and weeds from the planting site.

2.2 The hole should be a minimum 3 times the diameter of the container diameter.

2.2.1 Square containers shall be dug with a circular hole 3 times the container measurement.

2.3 Dig the hole, leaving an undisturbed pedestal in the center that the root ball will be set on.

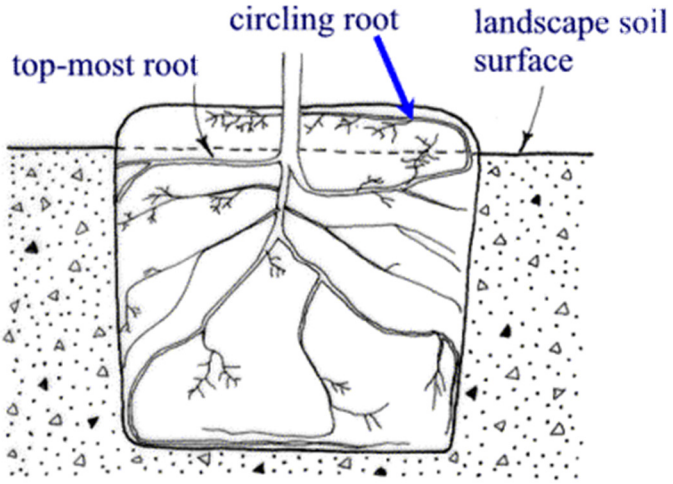
2.4 The pedestal shall be excavated to the depth measurement determined above

3.0 ROOT BALL PREPARATION

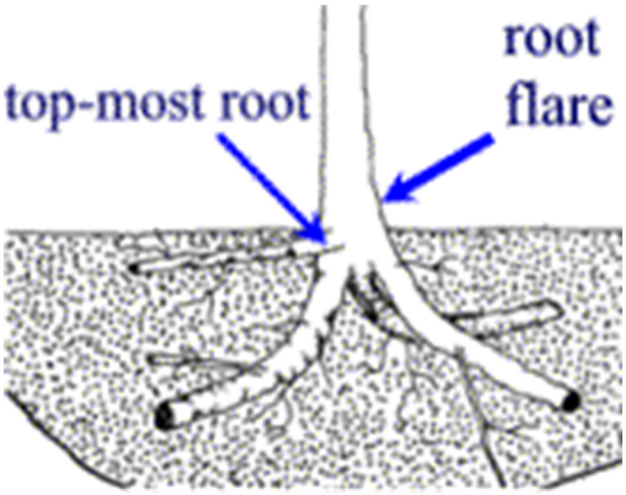
3.1 Loosen and straighten outside and bottom roots prior to placing the root ball on the pedestal. The trunk flare (the point where the trunk meets the roots) should be 1" above ground level.

3.2 Winding and girdling roots shall be pruned to either the point they are perpendicular to the root ball, or a point where they can be straightened and placed perpendicular to the root ball.

3.3 Keep the roots moist during this process so they do not dry out.



Container tree



Balled and Burlap or Bare Root tree

4.0 BACKFILL

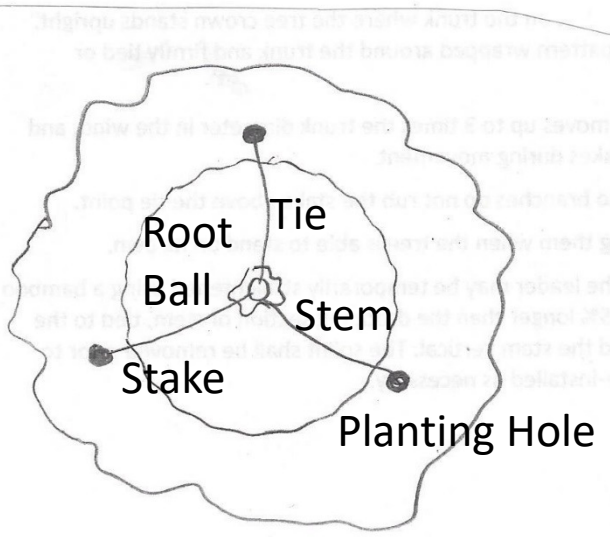
4.1 Hold the tree so the trunk and central leader are in a straight upright position.

4.2 Backfill soil with the soil you removed around the base of the pedestal and root ball no higher than 2/3, so the tree stands in the upright position

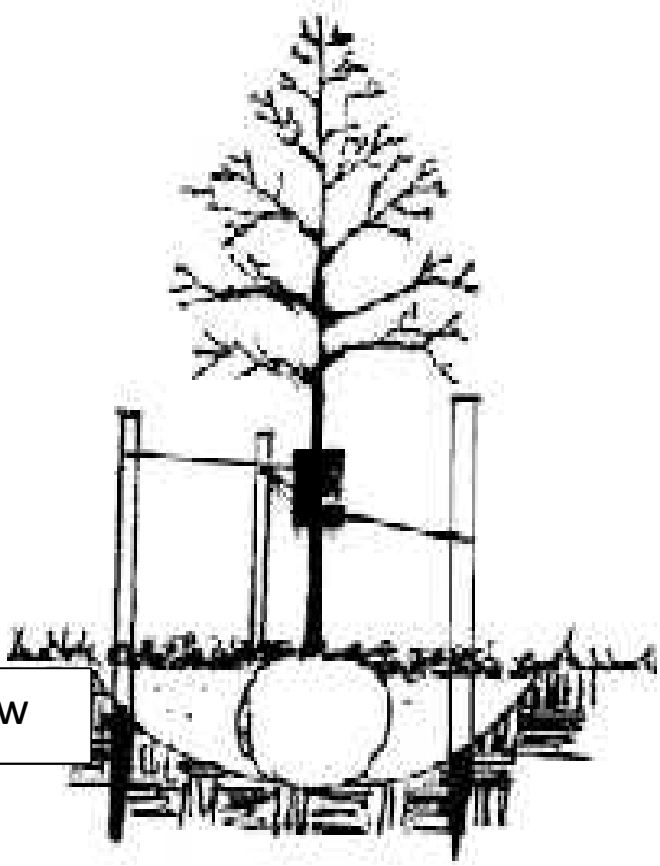
4.3 Tamp the soil to remove air gaps, or fill with water and allow soil to settle and drain. Continue to fill the entire hole with existing soil in layers and tamping, up to finished grade. Backfill soil shall not be placed on top of the root ball.

4.4 Build a berm at the outside edge of the root ball. The berm shall be a minimum 3 inches high and wide.

4.5 Cover the remainder of the backfill soil outside the berm with a set level of mulch (2 to 4 inches deep).



Three Stake Detail Top View



Side View

5.0 STAKING

5.1 Remove the nursery stake (the thin stake tied to the trunk) that is secured to the tree.

5.2 Install the appropriate number of stakes – for example, two stakes on the windward and leeward side of the tree, set at least 2 feet into the native soil outside the root ball.

5.2.1If the area is exceptionally windy, high traffic, or when specified, install 3 or 4 stakes spaced evenly around the circumference, outside the root ball.

5.3 One tie per stake shall be placed at the lowest point on the trunk where the tree crown stands upright. Ties shall be placed using a "figure 8" crossing pattern wrapped around the trunk and firmly tied or attached to the stake.

5.3.1 Ties shall be loose enough so the tree crown moves up to 3 times the trunk diameter in the wind, and taut enough that the trunk does not rub the stakes during movement.

5.4 The stakes shall be cut off above the tie point so branches do not rub the stake above the tie point.

5.5 Check the stakes and ties periodically, removing them when the tree is able to stand on its own.

5.6 If a leader that should be vertical is drooping, the leader may be temporarily straightened using a bamboo or small diameter wood splint approximately 25% longer than the drooping section of stem, tied to the stem at the top and bottom of the splint to hold the stem vertical. The splint shall be removed prior to girdling or constricting the stem, and may be re-installed as necessary.

6.0 Mulch

6.1 Apply a set depth (2 to 4 inches) of wood chips or other organic mulch over the planting hole excavated soil.

6.2 Mulch may be placed inside the berm and shall be kept at least 4" away from the trunk flare.

6.3 The soil area of the planting hole shall be kept clear of grass and landscape plantings.

7.0 Water/Irrigation

7.1 Apply water using a low-pressure application, i.e.: trickle from a hose, soaker hose, or bubbler.

7.2 Use low water volume to apply the water. Add water long enough to saturate the root ball and planting area.

7.2.1 Lawn sprinklers shall not be considered an acceptable method of applying irrigation to newly planted trees.

7.3 The initial watering frequency shall be checked by monitoring the soil moisture. Based on the temperature and humidity, learn how long the soil retains the moisture.

7.4 After the soil is below field capacity, and before it dries out, repeat the watering process, every so determined days.

7.4.1 As the weather and seasons change, the irrigation frequency may change. This will be evaluated by checking soil moisture following water application.

7.4.1.1 For example: you may learn irrigation should be applied twice a week during the fall, except in cool or rainy weather. Irrigation may need to be applied every two days during hot dry summer periods.

7.5 Irrigation shall be continued for the first three years after planting.

7.5.1 Avoiding drying out the root ball and adjacent soil is critical for tree growth and establishment.

8.0 Protect the trunk

8.1 Avoid damage from mowers and string trimmers to the tender bark of the young tree.

8.2 Maintain a clear area free of vegetation around the trunk in the berm or basin area.

8.3 Keep the set depth of mulch (2 to 4 inches) coverage of the area around the tree.

8.4 Retain temporary low branches along the trunk to shade and feed the trunk.

9.0 Pruning newly planted trees

9.1 Broken and dead branches shall be pruned.

9.2 A central leader shall be identified and retained if present. If co-dominant leaders are present, they shall be pruned to be shorter than the central leader by 20%.

9.3 All low temporary branches on the lower trunk shall be retained, and if needed shortened for clearance.

10. **FUTURE CARE**

10.1 During subsequent years, the berm should be enlarged or removed to in order to provide water to the increasing root growth. The watering area should target new root growth and projected root growth.

10.2 Pruning should retain a dominant central leader; and retain low temporary branches until trunk bark hardens or remove before branch diameter becomes too large.

NURSERY STOCK

Nursery Stock Purchase

Trees purchased for the subject project shall be the Genus, species, and cultivar specified in the purchase documents. Trees shall be grown to be free of bound root systems caused by winding roots or kinked roots from a previous smaller container. As trees are moved to larger containers, circling roots shall be either pruned to a point where they can grow straight, straightened in the new container, or removed. Kinked roots shall be pruned to a point where they will grow straight outward or downward. The trunk and branches shall be of a structure where a central leader is defined, or the central leader can be easily selected. The competing leaders have a smaller diameter, and can be pruned shorter.

Nursery Tree Quality

GENERAL SPECIFICATIONS

Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by species and cultivar (as appropriate).

Compliance: All trees shall comply with federal and state laws and regulations requiring inspection for plant disease, pests, and weeds. Inspection certiVicates required by law shall accompany each shipment of plants. Clearance from the local county agricultural commissioner, if required, shall be obtained before planting trees originating outside the county in which they are to be planted. Even though trees may conform to county, state, and federal laws, the buyer may impose additional requirements.

Inspection: The buyer reserves the right to reject trees that do not meet speciVications as set forth in these guidelines or as adopted by the buyer. If a particular defect or substandard element can be corrected easily, appropriate remedies shall be applied. If destructive inspection of a root ball is to be done, the buyer and seller shall have a prior agreement as to the time and place of inspection, number of trees to be inspected, and Vinancial responsibility for the inspected trees.

Delivery: The buyer shall stipulate how many days prior to delivery that delivery notiVication is needed. Buyer shall stipulate any special considerations to the nursery prior to shipment.

HEALTH AND STRUCTURE SPECIFICATIONS

These specifications apply to deciduous, broadleaf evergreen, and coniferous species. They do not apply to palms. Note that leaf characteristics will not be evident on deciduous trees during the dormant season.

Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar. The leader shall be intact to the very top of the tree.

Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of moisture stress as indicated by wilted, shriveled, or dead leaves.

Branches: Shoot growth (length and diameter) throughout the crown shall be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.

Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds (except properly made pruning cuts), sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, girdling ties, or lesions (mechanical injury). The terminal bud on the leader shall be intact to the very top of the tree, and it shall be the highest point on the tree.

Roots: The root system shall be substantially free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Root distribution shall be uniform throughout the container substrate, and shall be appropriate for the species or cultivar. At time of inspection and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

Shade trees that grow to be large shall have one relatively straight central leader. Heading the tree is acceptable provided the central leader is reestablished in the nursery.

Main branches shall be well distributed along the central leader, not clustered together. They shall form a balanced crown appropriate for the cultivar or species. The largest branches shall be free of bark inclusions that extend into the branch union.

Small-diameter branches, particularly on trees less than 1 inch caliper, should be present along the lower trunk below the lowest main branch. These branches shall be no larger than 3/8 inch in diameter.

The diameter of branches that grow from the central leader, or trunk, shall be no larger than two-thirds (one-half is preferred) the diameter of the trunk, measured just above the branch.

The root collar (the uppermost roots) shall be within the upper 2 inches of the soil media (substrate). The root collar and the inside portion of the root ball shall be free of defects, including circling, kinked, and stem-girdling roots. Roots at the surface should grow mostly straight towards the side of the container. For inspection of root defects, one may need to remove soil near the root collar.

The tree shall be well rooted in the soil media. Roots shall be uniformly distributed throughout the container, meaning that roots should not be concentrated at the bottom of the root ball. Some

roots should contact the container wall in the top half of the root ball. When the container is removed, the root ball shall remain intact. When the trunk is lifted, both the trunk and root system shall move as one. The imprint of the liner or smaller container shall not be visible.

The root ball shall be moist throughout at the time of inspection and delivery. The roots shall show no signs of excess soil moisture as indicated by poor root growth, root discoloration, distortion, death, or foul odor.

The foliar crown shall show no signs of moisture stress as indicated by wilted, shriveled, or dead leaves or branch dieback.

The trunk caliper (diameter) and taper shall be sufficient so that the tree remains vertical without a stake. The trunk shall be free of wounds, sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, or lesions. Properly made recent or closed pruning cuts are acceptable. Copyright © 2011 Brian Kempf and Ed Gilman. For illustrations visit: http://www.fire.ca.gov/resource_mgt/downloads/CALFIRE_Nursery_Standards_and_Specs11_12.pdf

APPENDIX 8 - PRUNING GUIDELINES AND SPECIFICATIONS

Guidelines

As the trees are determined to be retained and grown long term, the tree pruning that will maintain the optimum canopy should be performed in a block by block pruning cycle. Block by block pruning is the least expensive highest return on investment pruning. All trees should be pruned during the visit, with specific objectives for the trees based on their age:

Young trees receive structural pruning to establish the central leader, remove co-dominants, shorten competing leaders, retain temporary branches, and remove dead branches. This is typically low cost pruning, and can also be performed by trained residents who want to care for their trees. The tool of choice is hand pruners, which have a fairly safe work history. Young tree pruning actually is best performed over time, with few pruning actions at a time. They are best performed by trained homeowners and landscapers who can make a small snip today, watch the trees' responses and make other snips next week or month. Pruning for clearance is simple and usually does not require much foliage removal, and on small trees needs to be pruned routinely.

Middle aged trees usually need pole pruners, hand saws, lopper, and pole saws. Some work can be done with hand pruners on branch tips, but the height of the pruning and amount of foliage removed is usually a greater effort than trained volunteers are expected to perform. These trees are also pruned less frequently than young trees, and are starting to finalize their architecture. By medium size, if pruned well during their younger years, the structure should be in place, so clearance and long laterals are the focus of the pruning. Occasionally there will be crossing branches that may need to be removed to avoid interior foliage conflicts and rubbing branches. The main focus of pruning will begin to reduce end weights and retain the permanent branch structure.

Mature trees are trees too large for most volunteers to prune. The work is higher above the ground and needs to be performed by a climber or an aerial lift. The structure should be in place, and the main focus is clearance, end weight reduction, and removing dead branches.

The ability of Dougherty Valley to prune their trees from start through growth is an advantage to maintain the trees in good structure and minimize the risk of branch failure. The routine visits by tree care professionals should monitor the tree conditions, and reduce whole tree failures.

There are many young trees that have experienced lawn mower damage at the lower trunk, and some of these trees will end up requiring removal due to deterioration and decay of the base of the trees. The intent is to monitor these trees and phase removals growing the trees as long as possible, or at least balancing the removals with adjacent trees so several trees in a row are not removed at the same time.

Pruning Specifications

<u>Pruning Small Trees</u>

A central leader shall be selected and retained. Competing leaders and laterals shall be reduced to at least 12" below the central leader in height. Fast growing laterals that are growing taller than the central leader shall be shortened to allow the central leader to be taller and more vigorous. Branches are to be pruned by either reduction or branch removal cuts to achieve the appropriate structure, clearance over the area, and remove the desired branches. Temporary branches shall be left along the lower stem to shade the trunk. Temporary branches shall be shortened for necessary clearance, and shall be removed when they exceed 1" diameter.

The natural shape of the tree species shall be retained. The smallest diameter branches shall be removed to meet the objective, working from the branch tips towards the center, removing none to minimal interior foliage inside the final outward branch cut. Trees shall be pruned to remove dead branches to ½" diameter, weakly attached branches, and branches where significant damage has occurred by rubbing, animals, insects, or critical disease. All pruning cuts shall be made in accordance with American National Standards Institute (ANSI) A300 Part 1 Pruning Standards and International Society of Arboriculture (ISA) Best Management Practices for Pruning.

Pruning Medium Sized Established Trees

On trees up to six inches in diameter, all dead branches greater than one-half inch diameter shall be removed. All weakly attached branches and potential co-dominant branches shall either be reduced by at least 20% or be removed, as most appropriate for the long-term structure of the tree. The weakest or most damaged branch of a pair or group of rubbing branches shall be shortened to avoid rubbing, or removed. All temporary branches along the trunk should be retained and shortened to obtain necessary clearance. When either temporary branches exceed one-inch diameter, or the trunk forms mature bark, the temporary branches shall be removed.

Stakes shall be installed as necessary to support a straight growing tree, and reduce crooked growth caused by high wind. The trunk shall be supported at the lowest point to keep the crown supported straight, and the portions of the stake above the tie point cut off to avoid rubbing branches. After the tree becomes firmly rooted, and the stake is no longer necessary to support the tree, the stakes shall be removed.

Depending on the location and site needs, clearance should be performed by pruning the smallest branches inward from the branch tips until the permanent branches are in place. Clearance minimums should be set, for example: 7.5' over sidewalks, 10 feet over parking spaces, and 14.5 feet over truck traffic streets. Clearance pruning shall be carefully performed until the permanent branches are identified. Up to 25% of the total foliage on any tree should be the maximum removed during any planned pruning cycle. Follow-up pruning for structure or clearance on young trees can be performed at any time if pruning small amounts of foliage (up to 10%) and retaining the central leader and branch size relationships.

Depending on the location and site needs, clearance should be performed by pruning the smallest branches inward from the branch tips until the permanent branches are in place. Clearance minimums should be set, for example: 7.5' over sidewalks, 10 feet over parking spaces, and 14.5 feet over truck traffic streets. Clearance pruning shall be carefully performed until the permanent branches are identified. Up to 25% of the total foliage on any tree should be the maximum removed during any planned pruning cycle.

Any special site issues for utility clearance or conflicts with other objects shall be managed by early pruning to direct growth away from the target lines, overhead lights, flags, or buildings.

APPENDIX 9 - BMPS FOR RETAINING, REPLACING AND GROWING NEW TREES

This plan is designed to create the best practices for the City to make decisions about tree removal, replacement species, and tree spacing to grow the optimum sustainable tree canopy for the available space. We will organize the BMP's by work activity.

In those older locations that used the circular root barriers, if the trees are small enough, and the turf will be converted to mulch, the sites can be addressed with a combination of root pruning or trenching along the walkway and curb and gutter, and using the trench to install a root barrier and the new irrigation lines. If the existing trees are small enough, the linear root pruning should not require tree removal at this time. If the trees are too large, the root pruning may cause instability and the trees will need to be removed. In most situations, the root pruning can be performed, and the trees checked with a pull test for stability. If stable, they can be retained, if found unstable, they will need to be removed.

When sidewalk repairs occur, some root cutting will need to be performed, or the sidewalk would not need repair. If the root cutting is too extensive, the tree may become unstable, and the tree should be removed for safety to avoid unplanned failure. Additionally, when a tree is root pruned, the cut roots typically grow back to where they were just cut and removed from, and a root barrier should be installed to reduce the likelihood of the roots causing recurring damage. There are two types of root barriers recommended for use: plastic linear or chemical linear. The plastic linear barriers require a linear trench to be cut to install the barrier to deflect roots. The chemical barrier works with a fabric material with the chemical nodules embedded and smaller sections of the material can be installed around the cut root and reduce root tip elongation towards the area the roots were cut from.

Turf and Trees – can they be separated?

Removing turf and replacing mulch where there are no trees is simple – remove the turf and till the soil, adding amendments to reduce compaction, improve fertility and permeability; install the irrigation, trees, plants, and mulch.

There will need to be different methods of changing the turf to mulch around existing trees.

Young trees can likely have the turf removed, carefully close to the tree trunk; soil remediation outside the dripline of the trees or a minimum distance based on species and trunk diameter; replacement of landscape plants and mulch.

Older trees may need to have a combination of herbicide sprayed on the turf; careful installation of irrigation; installation of landscape plants and mulch.

Large trees that have filled most of the planting strip with surface roots and the root plate, is the result of a tree that is too large for the planting strip. In these situations, complete tree and root removal as well as soil remediation in the planting strip is appropriate. The renovation will occur when a new tree is planted.

If the sidewalk is being repaired, and the tree will be retained, turf can be killed with herbicide. The irrigation lines can be installed with the sidewalk replacement, which will be simpler if the sidewalk is being relocated, and landscape plants can be placed where room exists, and mulch installed.

APPENDIX 10 - ROOT PRUNING SPECIFICATIONS

Root loss can affect tree health and stability. "Cutting roots at a distance of greater than 6 times the trunk diameter (DBH) minimizes the likelihood of affecting both health and stability. At this distance, approximately 25% of the root system would be lost."

"Linear cuts on one side of a tree can reduce stability when the cut is made at a distance from the trunk that is less than three times the trunk diameter. Severe loss of stability is common when cuts are made at a distance that is less than 1 to 1.5 times the trunk diameter."[18]

Root pruning is less disruptive the younger and smaller the tree is. Young trees at planting can be extensively root pruned to retain a viable root structure, and the tree will survive and grow. As trees grow larger, root pruning can have a bigger impact on stability. The larger the foliar crown in both height and spread, the greater the force and leverage on the root system.

The optimum method to root prune is to excavate the soil and view the roots before cutting. This is very expensive and time consuming, and not usually possible in large scale community tree populations. The alternative is to perform either select root cutting on one or two visible roots, or linear root cutting adjacent to concrete or structures.

The following specification language should be followed for root pruning:

Linear root pruning shall occur at a distance of 3 times DBH or greater from the base of the trunk. If root pruning closer than this distance is necessary to mitigate a conflict, either selective root pruning shall be performed, or the tree will need to be removed.

Linear root pruning should not be performed on two sides of a tree during the same growing season.

Selective root pruning of individual roots shall not exceed greater than 2 roots per tree per growing season, performed on roots greater than 2 inches up to 6 inches, at a distance from the base of the trunk of 2 times the DBH or greater. If root pruning closer than this distance is necessary to mitigate a conflict, the tree will need to be removed.

For individual roots larger than 6 inches, one root may be pruned not closer than 3 times DBH from the base of the trunk. If root pruning closer than this distance is necessary to mitigate a conflict, the tree will need to be removed.

If stability is a concern, a pull test can be performed. The pull test will verify if root plate movement occurs at the root cut. If the root plate is found to move, the tree is found to be unstable. It will need to be removed.

[18] 2017. Costello, Larry; Gary Watson; and Tom Smiley. *ROOT MANAGEMENT BEST MANAGEMENT PRACTICES*. International Society of Arboriculture; page21 Consequences of Root Pruning on Tree Stability