

Appendix B: Biological Resources Supporting Information

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B.1 - CNDDDB Results

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Selected Elements by Common Name

California Department of Fish and Wildlife

California Natural Diversity Database



Query Criteria: Quad IS (Healdsburg (3812257))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Baker's navarretia <i>Navarretia leucocephala ssp. bakeri</i>	PDPLM0C0E1	None	None	G4T2	S2	1B.1
Burke's goldfields <i>Lasthenia burkei</i>	PDAST5L010	Endangered	Endangered	G1	S1	1B.1
burrowing owl <i>Athene cunicularia</i>	ABNSB10010	None	None	G4	S3	SSC
California linderiella <i>Linderiella occidentalis</i>	ICBRA06010	None	None	G2G3	S2S3	
coho salmon - central California coast ESU <i>Oncorhynchus kisutch pop. 4</i>	AFCHA02034	Endangered	Endangered	G4	S2?	
congested-headed hayfield tarplant <i>Hemizonia congesta ssp. congesta</i>	PDAST4R065	None	None	G5T2	S2	1B.2
dwarf downingia <i>Downingia pusilla</i>	PDCAM060C0	None	None	GU	S2	2B.2
foothill yellow-legged frog <i>Rana boylei</i>	AAABH01050	None	Candidate Threatened	G3	S3	SSC
great blue heron <i>Ardea herodias</i>	ABNGA04010	None	None	G5	S4	
many-flowered navarretia <i>Navarretia leucocephala ssp. plieantha</i>	PDPLM0C0E5	Endangered	Endangered	G4T1	S1	1B.2
marsh microseris <i>Microseris paludosa</i>	PDAST6E0D0	None	None	G2	S2	1B.2
Napa false indigo <i>Amorpha californica var. napensis</i>	PDFAB08012	None	None	G4T2	S2	1B.2
narrow-anthered brodiaea <i>Brodiaea leptandra</i>	PMLIL0C022	None	None	G3?	S3?	1B.2
Navarro roach <i>Lavinia symmetricus navarroensis</i>	AFCJB19023	None	None	G4T1T2	S2S3	SSC
Northern Hardpan Vernal Pool <i>Northern Hardpan Vernal Pool</i>	CTT44110CA	None	None	G3	S3.1	
osprey <i>Pandion haliaetus</i>	ABNKC01010	None	None	G5	S4	WL
pallid bat <i>Antrozous pallidus</i>	AMACC10010	None	None	G5	S3	SSC
pappose tarplant <i>Centromadia parryi ssp. parryi</i>	PDAST4R0P2	None	None	G3T2	S2	1B.2
red-bellied newt <i>Taricha rivularis</i>	AAAAF02020	None	None	G4	S2	SSC
Russian River tule perch <i>Hysterocarpus traskii pomo</i>	AFCQK02011	None	None	G5T4	S4	SSC



Selected Elements by Common Name
California Department of Fish and Wildlife
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Sebastopol meadowfoam <i>Limnanthes vincularis</i>	PDLIM02090	Endangered	Endangered	G1	S1	1B.1
Sonoma sunshine <i>Blennosperma bakeri</i>	PDAST1A010	Endangered	Endangered	G1	S1	1B.1
steelhead - central California coast DPS <i>Oncorhynchus mykiss irideus pop. 8</i>	AFCHA0209G	Threatened	None	G5T2T3Q	S2S3	
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	AMACC08010	None	None	G3G4	S2	SSC
western pond turtle <i>Emys marmorata</i>	ARAAD02030	None	None	G3G4	S3	SSC
white-tailed kite <i>Elanus leucurus</i>	ABNKC06010	None	None	G5	S3S4	FP

Record Count: 26

B.2 - CNPS Inventory Results

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Plant List

Inventory of Rare and Endangered Plants

12 matches found. *Click on scientific name for details*

Search Criteria

California Rare Plant Rank is one of [1B, 2B], FESA is one of [Endangered, Threatened], CESA is one of [Endangered, Threatened, Rare], Found in Quads 3812268, 3812267, 3812266, 3812258, 3812257, 3812256, 3812248 3812247 and 3812246;

[Modify Search Criteria](#) [Export to Excel](#) [Modify Columns](#) [Modify Sort](#) [Display Photos](#)

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Astragalus claranus	Clara Hunt's milk-vetch	Fabaceae	annual herb	Mar-May	1B.1	S1	G1
Blennosperma bakeri	Sonoma sunshine	Asteraceae	annual herb	Mar-May	1B.1	S1	G1
Chorizanthe valida	Sonoma spineflower	Polygonaceae	annual herb	Jun-Aug	1B.1	S1	G1
Clarkia imbricata	Vine Hill clarkia	Onagraceae	annual herb	Jun-Aug	1B.1	S1	G1
Cordylanthus tenuis ssp. capillaris	Pennell's bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jun-Sep	1B.2	S1	G4G5T1
Delphinium bakeri	Baker's larkspur	Ranunculaceae	perennial herb	Mar-May	1B.1	S1	G1
Delphinium luteum	golden larkspur	Ranunculaceae	perennial herb	Mar-May	1B.1	S1	G1
Lasthenia burkei	Burke's goldfields	Asteraceae	annual herb	Apr-Jun	1B.1	S1	G1
Lilium pardalinum ssp. pitkinense	Pitkin Marsh lily	Liliaceae	perennial bulbiferous herb	Jun-Jul	1B.1	S1	G5T1
Limnanthes vinculans	Sebastopol meadowfoam	Limnanthaceae	annual herb	Apr-May	1B.1	S1	G1
Navarretia leucocephala ssp. plieantha	many-flowered navarretia	Polemoniaceae	annual herb	May-Jun	1B.2	S1	G4T1
Sidalcea oregana ssp. valida	Kenwood Marsh checkerbloom	Malvaceae	perennial rhizomatous herb	Jun-Sep	1B.1	S1	G5T1

Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website <http://www.rareplants.cnps.org> [accessed 28 January 2019].

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Contributors

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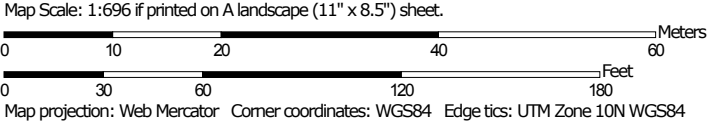
Questions and Comments

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B.3 - Soils Map

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Soil Map—Sonoma County, California



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sonoma County, California

Survey Area Data: Version 12, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 31, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HwB	Huichica loam, shallow, ponded, 0 to 5 percent slopes	2.5	100.0%
Totals for Area of Interest		2.5	100.0%

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B.4 - Arborist Report

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HORTICULTURAL *Associates*

Consultants in Horticulture and Arboriculture

TREE PRESERVATION AND MITIGATION REPORT

Shiloh Mixed Use Development
1200 Shiloh Road
Windsor, CA

Prepared For:

First Carbon Solutions
250 Commerce Drive, Suite 150
Irvine, CA 92602

Prepared by:

John C. Meserve
Consulting Arborist and Horticulturist
ISA Certified Arborist, WE #0478A
ISA Qualified Tree Risk Assessor

February 2, 2019

February 2, 2019

Mr. Jason Brandman
First Carbon Solutions
250 Commerce Drive, Suite 150
Irvine, CA 92602

Re: Completed *Tree Preservation and Mitigation Report*, Shiloh Mixed Use Development,
1200 Shiloh Road, Windsor, California

Jason,

Attached you will find our completed *Tree Preservation and Mitigation Report* for the above noted site in Windsor. A total of 20 trees were evaluated, and this includes all trees that are present over 6 inches in trunk diameter per the Windsor Tree Ordinance.

Each tree is identified in the field with a numbered aluminum tag placed on the trunk at approximately eye level.

All trees in this report were evaluated and documented for species, size, health, and structural condition. The *Tree Inventory Chart* includes our assessment of expected development impacts on each tree, and recommendations for action. The *Tree Location Plan* shows the location and numbering sequence of all evaluated trees. We have also included *Tree Protection Guidelines* and *Pruning Standards* for trees that will remain at the site.

This report is intended to be a basic inventory of trees present at this site, which includes a general review of tree health and structural condition. No in-depth evaluation has occurred on any tree, and assessment has included only external visual examination without probing, drilling, coring, root collar examination, root excavation, or dissecting any tree part. Failures, deficiencies, and problems may occur in these trees in the future, and this inventory in no way guarantees or provides a warranty for their condition.

EXISTING SITE CONDITION SUMMARY

The project site consists of a remnant home and empty property.

EXISTING TREE SUMMARY

Native species present included Valley Oak.

Non-native species present included Chinese Elm, Pin Oak, Catalpa, Coast Redwood, Monterey Pine, and Sweetgum. Coast Redwood and Monterey Pine are California native species, but are not native to this site.

The Monterey Pines are infested with bark beetles and will not survive long.


CONSTRUCTION IMPACT SUMMARY

The following summarizes our action recommendations:

- (14) Preservation possible and recommended
- (1) Removal required due to expected development impacts
- (2) Removal recommended due to existing poor condition and significant development impacts
- (3) Removal recommended due to poor existing condition and poor species characteristics

Please feel free to contact me if you have questions regarding this report, or if further discussion would be helpful.

Regards,


John C. Meserve
Consulting Arborist and Horticulturist
ISA Certified Arborist, WE #0478A
ISA Qualified Tree Risk Assessor



TREE INVENTORY CHART

TREE INVENTORY
1200 Shiloh Road
Windsor, CA

February 2, 2019

Tree #	Latin Name	Common Name	Trunk (dbh ± inches)	Height (± feet)	Canopy Radius (± feet)	Health (1-5)	Structure (1-4)	Development Impact	Recommendations
1	<i>Quercus lobata</i>	Valley Oak	8	20	8	3	3	3	1
2	<i>Quercus lobata</i>	Valley Oak	10+11	32	16	3	3	2	1, 6, 7, 8, 9
3	<i>Ulmus parvifolia</i>	Chinese Elm	9.5	30	21	3	3	2	1, 6, 7, 8, 9
4	<i>Quercus palustris</i>	Pin Oak	5.5	20	11	4	3	2	1, 6, 7, 8, 9
5	<i>Catalpa speciosa</i>	Catalpa	11+12+10	32	19	2	2	3	4
6	<i>Sequoia sempervirens</i>	Coast Redwood	4.5	12	4	2	3	3	4
7	<i>Pinus radiata</i>	Monterey Pine	11+15.5+9.5	35	21	2	2	1	3, 5
8	<i>Liquidambar styraciflua</i>	Sweetgum	5	18	6	3	3	1	1, 6, 7, 8, 9
9	<i>Liquidambar styraciflua</i>	Sweetgum	5.5	20	8	3	3	1	1, 6, 7, 8, 9
10	<i>Liquidambar styraciflua</i>	Sweetgum	5	20	8	3	3	1	1, 6, 7, 8, 9
11	<i>Liquidambar styraciflua</i>	Sweetgum	5.5	20	8	3	3	1	1, 6, 7, 8, 9
12	<i>Liquidambar styraciflua</i>	Sweetgum	5.5	20	8	3	3	1	1, 6, 7, 8, 9
13	<i>Liquidambar styraciflua</i>	Sweetgum	6	20	8	3	3	1	1, 6, 7, 8, 9

TREE INVENTORY
1200 Shiloh Road
Windsor, CA

February 2, 2019

Tree #	Latin Name	Common Name	Trunk (dbh ± inches)	Height (± feet)	Canopy Radius (± feet)	Health (1-5)	Structure (1-4)	Development Impact	Recommendations
14	<i>Liquidambar styraciflua</i>	Sweetgum	5	20	8	3	3	1	1, 6, 7, 8, 9
15	<i>Pinus radiata</i>	Monterey Pine	19	35	14	3	3	2	3, 5
16	<i>Liquidambar styraciflua</i>	Sweetgum	5	20	8	3	3	2	1, 6, 7, 8, 9
17	<i>Liquidambar styraciflua</i>	Sweetgum	4	18	7	3	3	2	1, 6, 7, 8, 9
18	<i>Liquidambar styraciflua</i>	Sweetgum	5	18	7	3	3	2	1, 6, 7, 8, 9
19	<i>Liquidambar styraciflua</i>	Sweetgum	5.5	20	7	3	3	2	1, 6, 7, 8, 9
20	<i>Pinus radiata</i>	Monterey Pine	15.5	38	14	2	3	1	3, 5

KEY TO TREE
INVENTORY CHART

KEY TO TREE INVENTORY CHART

Tree Number

Each tree has been identified in the field with an aluminum tag and reference number. Tags are attached to the trunk at approximately eye level and the *Tree Location Plan* illustrates the location of each numbered tree.

Species

Each tree has been identified by genus, species and common name. Many species have more than one common name.

Trunk

Each trunk has been measured, to the nearest one half inch, to document its diameter at 4 feet above adjacent grade. Trunk diameter is a good indicator of age, and is commonly used to determine mitigation replacement requirements.

Height

Height is estimated in feet, using visual assessment.

Radius

Radius is estimated in feet, using visual assessment. Since many canopies are asymmetrical, it is not uncommon for a radius estimate to be an average of the canopy size.

Health

The following descriptions are used to rate the health of a tree. Trees with a rating of 4 or 5 are very good candidates for preservation and will tolerate more construction impacts than trees in poorer condition. Trees with a rating of 3 may or may not be good candidates for preservation, depending on the species and expected construction impacts. Trees with a rating of 1 or 2 are generally poor candidates for preservation.

- (5) Excellent - health and vigor are exceptional, no pest, disease, or distress symptoms.
- (4) Good - health and vigor are average, no significant or specific distress symptoms, no significant pest or disease.
- (3) Fair - health and vigor are somewhat compromised, distress is visible, pest or disease may be present and affecting health, problems are generally correctable.
- (2) Marginal - health and vigor are significantly compromised, distress is highly visible and present to the degree that survivability is in question.
- (1) Poor - decline has progressed beyond the point of being able to return to a healthy condition again. Long-term survival is not expected. This designation includes dead trees.

Structure

The following descriptions are used to rate the structural integrity of a tree. Trees with a rating of 3 or 4 are generally stable, sound trees which do not require significant pruning, although cleaning, thinning, or raising the canopy might be desirable. Trees with a rating of 2 are generally poor candidates for preservation unless they are preserved well away from improvements or active use areas. Significant time and effort would be required to reconstruct the canopy and improve structural integrity. Trees with a rating of 1 are hazardous and should be removed.

- (4) Good structure - minor structural problems may be present which do not require corrective action.
- (3) Moderate structure - normal, typical structural issues which can be corrected with pruning.
- (2) Marginal structure - serious structural problems are present which may or may not be correctable with pruning, cabling, bracing, etc.
- (1) Poor structure - hazardous structural condition which cannot be effectively corrected with pruning or other measures, may require removal depending on location and the presence of targets.

Development Impacts

Considering the proximity of construction activities, type of activities, tree species, and tree condition - the following ratings are used to estimate the amount of impact on tree health and stability. Most trees will tolerate a (1) rating, many trees could tolerate a (2) rating with careful consideration and mitigation, but trees with a (3) rating are poor candidates for preservation due to their very close proximity to construction or because they are located within the footprint of construction and cannot be preserved.

- (3) A significant impact on long term tree integrity can be expected as a result of proposed development.
- (2) A moderate impact on long term tree integrity can be expected as a result of proposed development.
- (1) A very minor or no impact on long term tree integrity can be expected as a result of proposed development.
- (0) No impact is expected

Recommendations

Recommendations are provided for removal or preservation. For those being preserved, protection measures and mitigation procedures to offset impacts and improve tree health are provided.

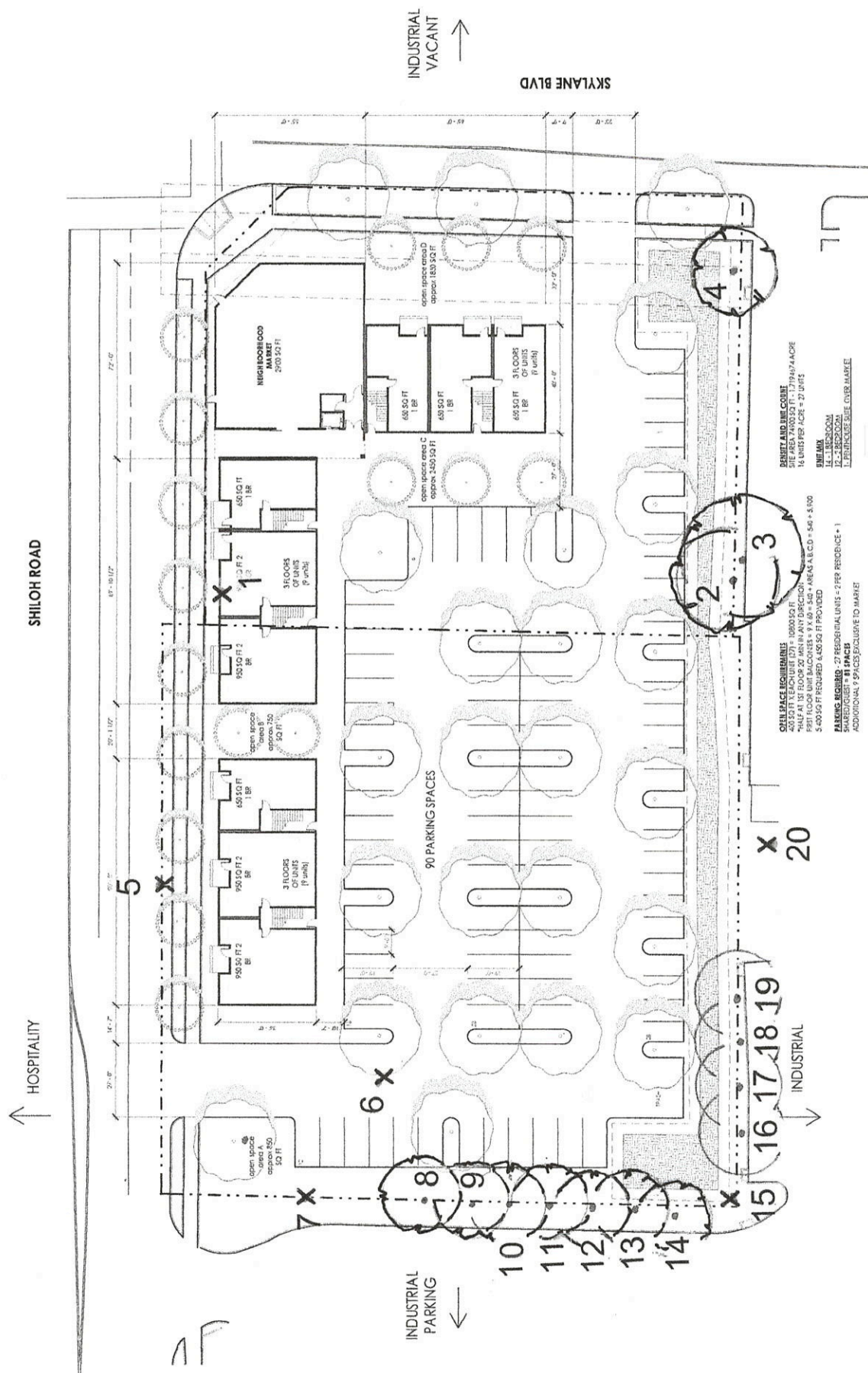
- (1) Preservation appears to be possible.
- (2) Removal is required due to significant development impacts.
- (3) Removal is recommended due to poor health or hazardous structure.

- (4) Removal is required due to significant development impacts and poor existing condition.
- (5) Removal is recommended due to poor species characteristics.
- (6) Install temporary protective fencing at the edge of the dripline, or edge of approved construction, prior to beginning grading or construction. Maintain fencing in place for duration of all construction activity in the area.
- (7) Maintain existing grade within the fenced portion of the dripline. Route drainage swales and all underground work outside the dripline.
- (8) Place a 4" layer of chipped bark mulch over the soil surface within the fenced dripline prior to installing temporary fencing. Maintain this layer of mulch throughout construction.
- (9) Prune to clean, raise, or provide necessary clearance. Prune to reduce branches that are over-loaded, over-extended, largely horizontal, arching, or have foliage concentrated near the branch ends, per International Society of Arboriculture Pruning Standards.

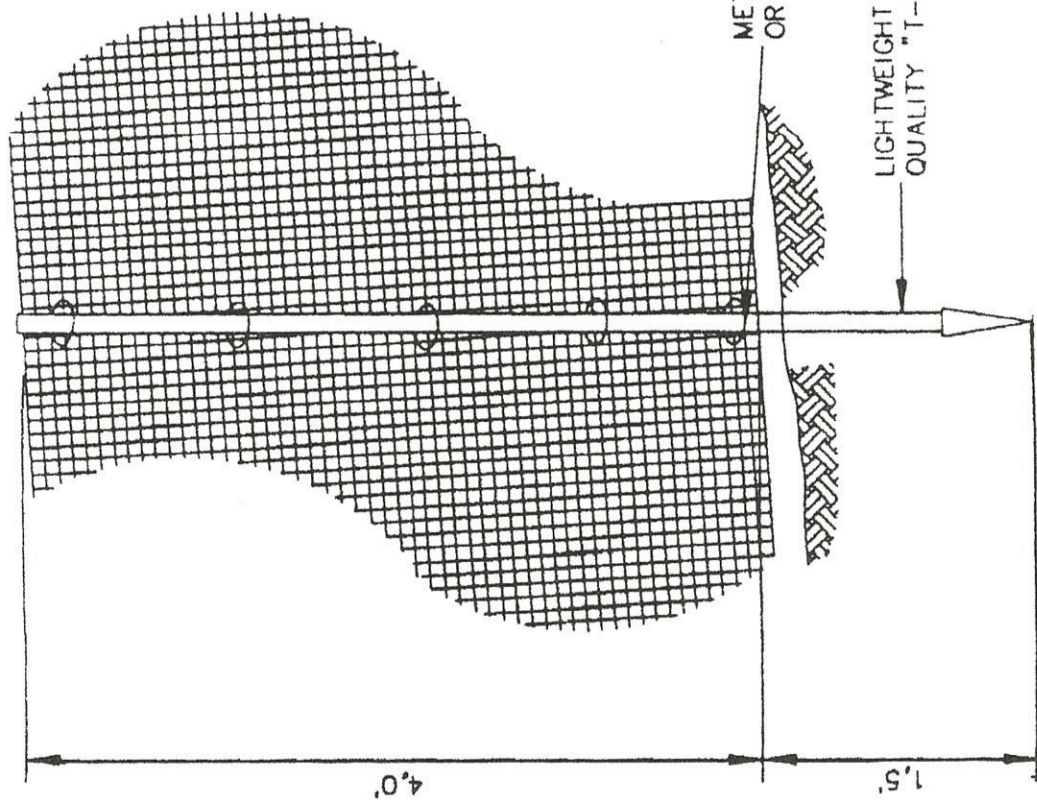
Pruning to occur by, or under the supervision of, an Arborist certified by the International Society of Arboriculture. Pruning Standards are attached to this report.

TREE LOCATION PLAN

JOHN C. MESERVE
CONSULTING ARBORIST
International Society of Arboriculture,
Certified Arborist WE #0478A
HORTICULTURAL ASSOCIATES
P.O. BOX 1261 / GLEN ELLEN, CA 95442
707/935-3911



TREE FENCING DETAIL



NOTE:
 TENSOR LIGHTWEIGHT SAFETY GRID, ORANGE
 COLOR, BX226516, CUT OR FOLD AT POSTS
 AS NEEDED TO CONFORM TO SLOPING TERRAIN.

METAL TIE WIRE, FLIP TIE
 OR EQUIVALENT, 5 PER POST

LIGHTWEIGHT 5 1/2' HIGH STANDARD FARM
 QUALITY "T-POST" PLACED 8' C-C

TREE PROTECTION FENCING DETAIL

TREE PROTECTION GUIDELINES

TREE PROTECTION GUIDELINES FOR CONSTRUCTION AROUND PRESERVED TREES

TREE PROTECTION ZONE

The Tree Protection Zone is illustrated on the Improvement Plans and represents the area around each tree, or group of trees, which must be protected at all times with tree protection fencing. No encroachment into the Tree Protection Zone is allowed at any time without approval from the project arborist, and unauthorized entry may be subject to civil action and penalties.

The protected area beneath the canopy of each tree will be designated by the project arborist as the Tree Protection Zone at a location determined to be adequate to ensure long term tree viability and health. The Tree Protection Zone may not be consistent with the canopy dripline in many locations.

TREE PROTECTION FENCING

Prior to initiating any construction activity on a construction project, including demolition, vegetation or approved tree removal, grubbing, or grading, temporary protective fencing shall be installed at each site tree or group of trees. Fencing shall be located at the edge of the Tree Protection Zone as specifically designated by the project arborist.

Fencing shall be minimum 4' height at all locations, and shall form a continuous barrier without entry points around all individual trees, or groups of trees. Barrier type fencing such as *Tensar* plastic fencing is recommended, but any fencing system that adequately prevents entry will be considered for approval by the project arborist. The use of post and cable fencing is not acceptable.

Fencing shall be installed in a professional manner using standard quality farm 'T' posts that are placed no more than 8 feet on center. Fencing shall be attached to each post at 5 locations with plastic electrical ties. Fencing shall be stretched tightly between posts in all locations. See fencing detail.

Fencing shall serve as a barrier to prevent encroachment of any type by construction activities including equipment, building materials, storage, outhouses, or personnel.

All encroachment into the fenced Tree Protection Zone must be approved in writing and supervised by the project arborist. Fencing relocation from original placement must also be approved in writing and be approved by the project arborist. Approved Tree Protection Zone encroachment may require additional

mitigation or protection measures that will be determined by the project arborist at the time of the request.

Contractors and subcontractors shall direct all equipment and personnel to remain outside the fenced area at all times until project is complete, and shall instruct personnel and sub-contractors as to the purpose and importance of fencing and preservation. All contractors and subcontractors are notified by this specification that there will be no exceptions without prior written approval.

Fencing shall be upright and functional at all times prior to demolition and grading and through completion of construction in the specific area of protected trees. If the project is to occur in phases fencing may be removed as each phase is completed.

GRADING AND TRENCHING

Any construction activity that necessitates soil excavation in the vicinity of preserved trees shall be avoided where possible, or be appropriately mitigated under the guidance of the project arborist. All contractors must be aware at all times that specific protection measures are defined, and non-conformance may generate stop-work orders.

The designated Tree Protection Zone is defined around all site trees to be preserved. Fences protect the designated areas. No grading or trenching is to occur within this defined area unless so designated by the Improvement Plan, and where designated shall occur under the direct supervision of the project arborist.

Trenching should be routed around the Tree Protection Zone whenever possible. Where trenching has been designated within the Tree protection Zone, utilization of underground technology to bore, tunnel or excavate with high-pressure air or water will be specified. Hand digging will be generally discouraged unless site conditions restrict the use of alternate technology.

All roots greater than one inch in diameter shall be cleanly hand-cut as they are encountered in any trench or in any grading activity. The tearing of roots by equipment of any type shall not be allowed. Mitigation treatment of pruned roots shall be specified by the project arborist as determined by the degree of root pruning, location of root pruning, and potential exposure to desiccation. No pruning paints or sealants shall be used on cut roots.

Where significant roots are encountered mitigation measures such as supplemental irrigation and/or organic mulches may be specified by the project arborist to offset the reduction of root system capacity.

Retaining walls are effective at holding grade changes outside the area of the Tree Protection Zone and are recommended where necessary. Retaining walls shall be constructed in post and beam or drilled pier construction styles where they are necessary near or within the Tree Protection Zone.

Placement of fill soils is generally discouraged within the Tree Protection Zone, but in some approved locations may be approved to cover up to 30% of this area. The species and condition of the tree shall be considered, as well as site and soil conditions, and depth of fill. Retaining walls should be utilized to minimize the area of fill within the Tree Protection Zone. Type of fill soil and placement methods shall be specified by the project arborist.

Grade changes near or within the Tree Protection Zone shall be designed so that surface drainage will not be diverted toward or around the root crown in any manner. Grade shall drain away from root crown at a minimum of 2%. If grading toward the root collar is unavoidable, appropriate surface and/or subsurface drain facilities shall be installed so that water is effectively diverted away from root collar area.

Approved fill soils within the Tree Protection Zone may also be mitigated using aerated gravel layers as specified by the project arborist.

Tree roots will be expected to grow into areas of soil fill, and quality of imported soil shall be considered. Fill soil shall be site topsoil that closely matches that present within the root zone area. When import soil is utilized it must be the same or slightly coarser texture than existing site soil, should have a pH range comparable to site soils, and generally should have acceptable chemical properties for appropriate plant growth. A soil analysis is required prior to soil importation to evaluate import soil for these criteria.

Grade reduction within the designated Tree Protection Zones shall be generally discouraged, and where approved, shall be conducted only after careful consideration and coordination with the project arborist.

Foundations or footings of any type within the Tree Protection Zone shall be constructed using design techniques that eliminate the need for trenching into natural grade. These techniques might include drilled piers, grade beams, bridges, or cantilevered structures.

TREE DAMAGE

Any form of tree damage which occurs during the demolition, grading, or construction process shall be evaluated by the project arborist. Specific mitigation measures will be developed to compensate for or correct the damage. Fines and penalties may also be levied.

Measures may include, but are not limited to, the following:

- pruning to remove damaged limbs or wood
- bark scoring to remove damaged bark and promote callous formation
- alleviation of compaction by lightly scarifying the soil surface
- installation of a specific mulching material
- supplemental irrigation during the growing season for up to 5 years
- treatment with specific amendments intended to promote health, vigor, or root growth
- vertical mulching or soil fracturing to promote root growth
- periodic post-construction monitoring at the developer's expense
- tree replacement, or payment of the established appraised value, if the damage is so severe that long term survival is not expected

MULCHING

Trees will generally benefit from the application of a 4 inch layer of chipped bark mulch over the soil surface within the greater root zone area. Ideal mulch material is a chipped bark containing a wide range of particle sizes. Bark mulches composed of shredded redwood, bark screened for uniformity of size, or chipped lumber are not acceptable. Rock and gravel mulches are also not acceptable due to their minimal benefit.

Chipped bark mulch may not originate from any tree infected with, or exhibiting symptoms of, Sudden Oak Death (SOD) due to the potential of infecting existing site trees.

TREE PRUNING AND TREATMENT

All recommendations for pruning or other treatments must be completed prior to acceptance of the project. It is strongly recommended that pruning be completed prior to the start of grading to facilitate optimum logistics and access.

TREE PRUNING STANDARDS

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WESTERN



CHAPTER

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International Society of Arboriculture

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Certification Committee • P.O. Box 424 • St. Helena, California 94574

ISA

PRUNING STANDARDS

Purpose:

Trees and other woody plants respond in specific and predictable ways to pruning and other maintenance practices. Careful study of these responses has led to pruning practices which best preserve and enhance the beauty, structural integrity, and functional value of trees.

In an effort to promote practices which encourage the preservation of tree structure and health, the W.C. ISA Certification Committee has established the following Standards of Pruning for Certified Arborists. The Standards are presented as working guidelines, recognizing that trees are individually unique in form and structure, and that their pruning needs may not always fit strict rules. The Certified Arborist must take responsibility for special pruning practices that vary greatly from these Standards.

I. Pruning Techniques

- A. A thinning cut removes a branch at its point of attachment or shortens it to a lateral large enough to assume the terminal role. Thinning opens up a tree, reduces weight on heavy limbs, can reduce a tree's height, distributes ensuing invigoration throughout a tree and helps retain the tree's natural shape. Thinning cuts are therefore preferred in tree pruning.

When shortening a branch or leader, the lateral to which it is cut should be at least one-half the diameter of the cut being made. Removal of a branch or leader back to a sufficiently large lateral is often called "drop crotching."

- B. A heading cut removes a branch to a stub, a bud or a lateral branch not large enough to assume the terminal role. Heading cuts should seldom be used because vigorous, weakly attached upright sprouts are forced just below such cuts, and the tree's natural form is altered. In some situations, branch stubs die or produce only weak sprouts.

- C. When removing a live branch, pruning cuts should be made in branch tissue just outside the branch bark ridge and collar, which are trunk tissue. *(Figure 1)* If no collar is visible, the angle of the cut should approximate the angle formed by the branch bark ridge and the trunk. *(Figure 2)*
- D. When removing a dead branch, the final cut should be made outside the collar of live callus tissue. If the collar has grown out along the branch stub, only the dead stub should be removed, the live collar should remain intact, and uninjured. *(Figure 3)*
- E. When reducing the length of a branch or the height of a leader, the final cut should be made just beyond (without violating) the branch bark ridge of the branch being cut to. The cut should approximately bisect the angle formed by the branch bark ridge and an imaginary line perpendicular to the trunk or branch cut. *(Figure 4)*
- F. A goal of structural pruning is to maintain the size of lateral branches to less than three-fourths the diameter of the parent branch or trunk. If the branch is codominant or close to the size of the parent branch, thin the branch's foliage by 15% to 25%, particularly near the terminal. Thin the parent branch less, if at all. This will allow the parent branch to grow at a faster rate, will reduce the weight of the lateral branch, slow its total growth, and develop a stronger branch attachment. If this does not appear appropriate, the branch should be completely removed or shortened to a large lateral. *(Figure 5)*
- G. On large-growing trees, except whorl-branching conifers, branches that are more than one-third the diameter of the trunk should be spaced along the trunk at least 18 inches apart, on center. If this is not possible because of the present size of the tree, such branches should have their foliage thinned 15% to 25%, particularly near their terminals. *(Figure 6)*
- H. Pruning cuts should be clean and smooth with the bark at the edge of the cut firmly attached to the wood.
- I. Large or heavy branches that cannot be thrown clear, should be lowered on ropes to prevent injury to the tree or other property.
- J. Wound dressings and tree paints have not been shown to be effective in preventing or reducing decay. They are therefore not recommended for routine use when pruning.

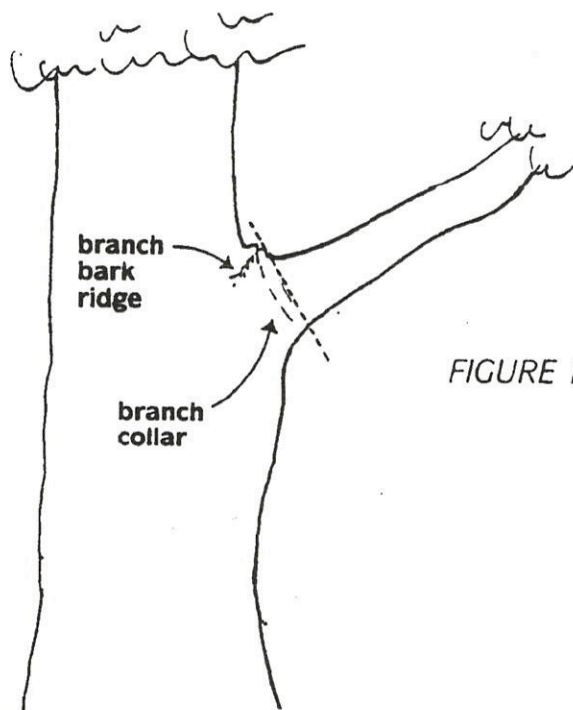


FIGURE 1. When removing a branch, the final cut should be just outside the branch bark ridge and collar.

FIGURE 2. In removing a limb without a branch collar, the angle of the final cut to the branch bark ridge should approximate the angle the branch bark ridge forms with the limb. Angle AB should equal Angle BC.

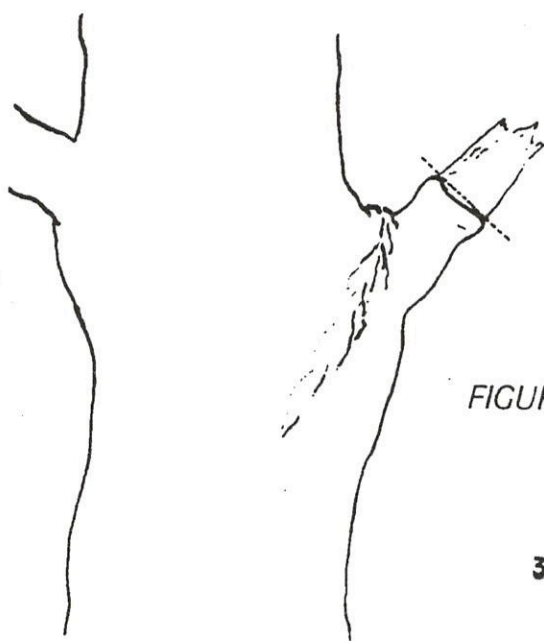
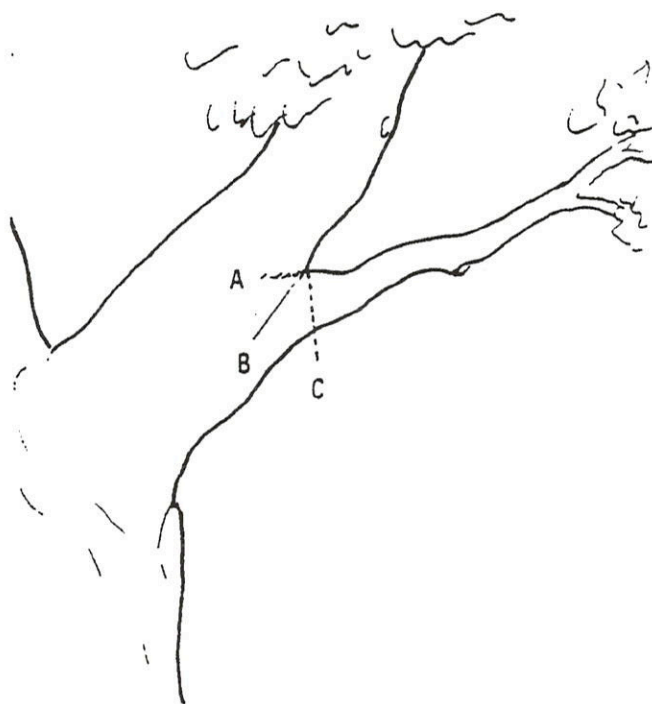


FIGURE 3. When removing a dead branch, cut outside the callus tissue that has begun to form around the branch.

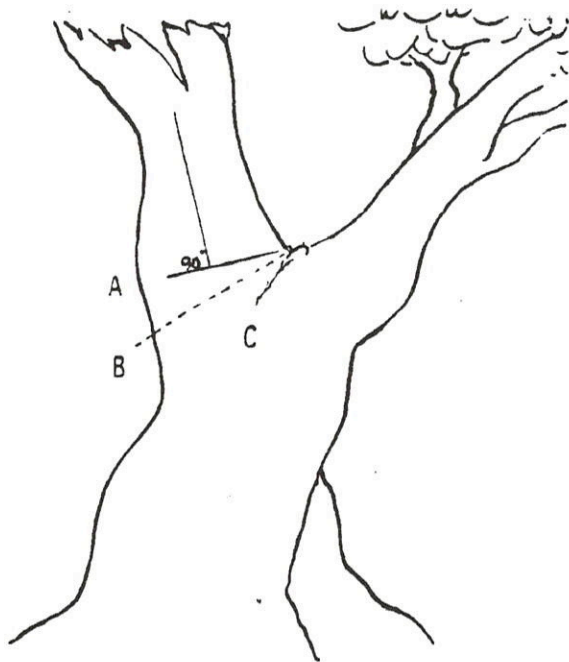
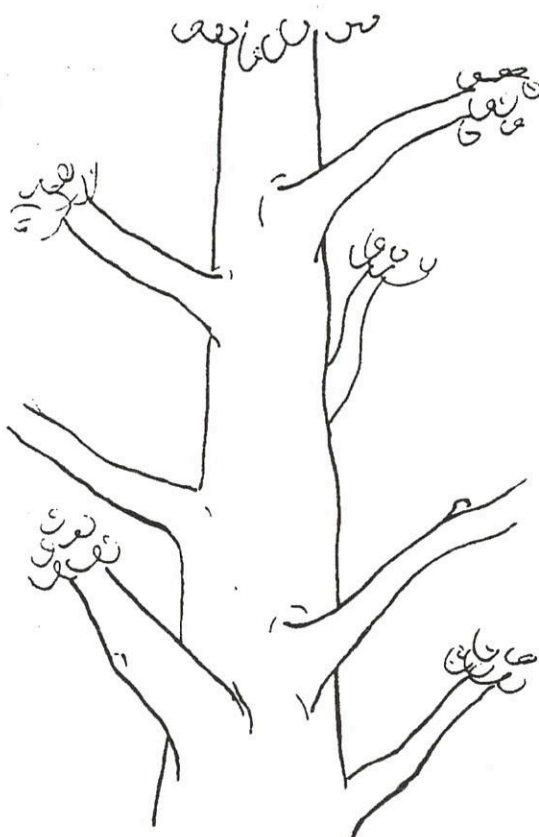


FIGURE 4. In removing the end of a limb to a large lateral branch, the final cut is made along a line that bisects the angle between the branch bark ridge and a line perpendicular to the limb being removed. Angle AB is equal to Angle BC.

FIGURE 5. A tree with limbs tending to be equal-sized, or codominant. Limbs marked B are greater than $\frac{3}{4}$ the size of the parent limb A. Thin the foliage of branch B more than branch A to slow its growth and develop a stronger branch attachment.



FIGURE 6. Major branches should be well spaced both along and around the stem.



II. Types of Pruning — Mature Trees

A. CROWN CLEANING

Crown cleaning or cleaning out is the removal of dead, dying, diseased, crowded, weakly attached, and low-vigor branches and watersprouts from a tree crown.

B. CROWN THINNING

Crown thinning includes crown cleaning and the selective removal of branches to increase light penetration and air movement into the crown. Increased light and air stimulates and maintains interior foliage, which in turn improves branch taper and strength. Thinning reduces the wind-sail effect of the crown and the weight of heavy limbs. Thinning the crown can emphasize the structural beauty of trunk and branches as well as improve the growth of plants beneath the tree by increasing light penetration. When thinning the crown of mature trees, seldom should more than one-third of the live foliage be removed.

At least one-half of the foliage should be on branches that arise in the lower two-thirds of the trees. Likewise, when thinning laterals from a limb, an effort should be made to retain inner lateral branches and leave the same distribution of foliage along the branch. Trees and branches so pruned will have stress more evenly distributed throughout the tree or along a branch.

An effect known as "lion's-tailing" results from pruning out the inside lateral branches. Lion's-tailing, by removing all the inner foliage, displaces the weight to the ends of the branches and may result in sunburned branches, watersprouts, weakened branch structure and limb breakage.

C. CROWN REDUCTION

Crown reduction is used to reduce the height and/or spread of a tree. Thinning cuts are most effective in maintaining the structural integrity and natural form of a tree and in delaying the time when it will need to be pruned again. The lateral to which a branch or trunk is cut should be at least one-half the diameter of the cut being made.

D. CROWN RESTORATION

Crown restoration can improve the structure and appearance of trees that have been topped or severely pruned using heading cuts. One to three sprouts on main branch stubs should be selected to reform a more natural appearing crown. Selected vigorous sprouts may need to be thinned to a lateral, or even headed, to control length growth in order to ensure adequate attachment for the size of the sprout. Restoration may require several prunings over a number of years.

II. Types of Pruning — Mature Trees (*continued*)

E. CROWN RAISING

Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas. It is important that a tree have at least one-half of its foliage on branches that originate in the lower two-thirds of its crown to ensure a well-formed, tapered structure and to uniformly distribute stress within a tree.

When pruning for view, it is preferable to develop "windows" through the foliage of the tree, rather than to severely raise or reduce the crown.

III. Size of Pruning Cuts

Each of the Pruning Techniques (Section I) and Types of Pruning (Section II) can be done to different levels of detail or refinement. The removal of many small branches rather than a few large branches will require more time, but will produce a less-pruned appearance, will force fewer watersprouts and will help to maintain the vitality and structure of the tree. Designating the maximum size (base diameter) that any occasional undesirable branch may be left within the tree crown, such as $\frac{1}{2}$ ", 1" or 2" branch diameter, will establish the degree of pruning desired.

IV. Climbing Techniques

- A. Climbing and pruning practices should not injure the tree except for the pruning cuts.
- B. Climbing spurs or gaffs should not be used when pruning a tree, unless the branches are more than throw-line distance apart. In such cases, the spurs should be removed once the climber is tied in.
- C. Spurs may be used to reach an injured climber and when removing a tree.
- D. Rope injury to thin barked trees from loading out heavy limbs should be avoided by installing a block in the tree to carry the load. This technique may also be used to reduce injury to a crotch from the climber's line.

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