

**DRAFT
TECHNICAL MEMORANDUM**

TO: Jim Rioux, City of Olympia

FROM: Jessica Stone

DATE: March 21, 2014

RE: **DRAFT LEVEL V TREE PLAN UPDATE
WEST BAY DRIVE NW SIDEWALK PROJECT
OLYMPIA, WASHINGTON**

INTRODUCTION

The City of Olympia (City) is proposing to install sidewalks along the west side of the West Bay Drive NW corridor from 1515 West Bay Drive NW to 1115 West Bay Drive NW in Olympia, Washington (project site; Figure 1). The purpose of the project is to increase pedestrian safety and create a pedestrian friendly corridor along West Bay Drive. The project site extends approximately 1,500 linear feet adjacent to the west side of West Bay Drive NW. The existing corridor consists of a two-lane road which winds between West Bay to the east and residential areas and small businesses located on the adjacent slope to the west. These sidewalks will include stormwater infrastructure (storm drains) and planting strips where applicable.

Landau Associates, under contract to the City, is providing this Level V Tree Plan to mitigate for tree removal to support the West Bay Drive NW sidewalk project. This technical memorandum documents the current site conditions and planting plan for compliance with Chapter 16.60 Tree Protection and Replacement of the City of Olympia Municipal Code (OMC).

REGULATORY BACKGROUND

Chapter 16.60 of the OMC includes provisions for the protection, preservation, replacement, proper maintenance, and use of trees and woodlands to enhance the City's physical and aesthetic character by preventing untimely and indiscriminate removal or destruction of trees. This also includes "protecting the trees and woodlands of this City for their economic support of local property values and to preserve and enhance the Pacific Northwest's natural beauty." Chapter 16.60 of the OMC provides tree preservation priority, required tree densities, and tree replacement criteria.

In accordance with OMC 16.60.050 this project, which consists of a site disturbance in developed commercial, industrial, and residential areas, requires a Level II Tree Plan. However, in consulting with the City's Community Development and Planning Department, the City's Public Works Department concluded that due to the adjacent steep slopes and potential impacts to adjacent property owners, a Level

V Tree Plan should be prepared. The Level V Tree Plan requirements are outlined in the City's Urban Forestry Manual (City of Olympia 2013), and includes:

- A tree inventory on a site plan which describes site conditions such as average tree and basal area per acre by species and 6-inch diameter class, description of potential tree preservation, and description of any offsite trees which could be adversely affected
- A tree protection plan which identifies the groves of trees or individual trees to be protected, the limits of construction, description and detail of tree protection and maintenance measures, and construction timelines
- A planting plan which shows the location, size, species and number of trees to be planted; narrative of site preparation and maintenance measures; planting timelines; cost estimates; and tree density calculations.

In addition to the requirements under Chapter 16.60 of the OMC, this Level V Tree plan presents a mitigation plan to restore temporary buffer impacts to Wetland A due to tree removal associated with the proposed improvements in accordance with OMC 18.32.540, and as described in the Wetland, Stream, and Buffer Mitigation Report prepared for the project (Landau Associates 2014a).

The complete Level V Tree plan will be provided under separate cover and includes the tree inventory (Figure T-1), tree protection plan (Figures T-2 through T-6 with details on Figure T-13), and the planting plan which includes the mitigation planting plan (Figures T-7 through 12 with details on Figure T-13).

EXISTING SITE CONDITIONS

The project is located in Olympia along West Bay Drive NW in Section 31, Township 10 North, and Range 8 West. Existing land use in the area consists of commercial/industrial land to the east and residential/professional offices to the west. West Bay Drive NW extends to the north and south beyond the project site. West Bay is located east of the adjacent commercial/industrial land. Topography primarily consists of steep slopes (up to 1H:1V) and relatively level areas associated with current development. Development within the project site primarily consists of commercial buildings, driveways to private residences, and paved or compacted gravel lots. The remaining area includes slopes forested primarily by red alder (*Alnus rubra*) with a dense understory dominated primarily by invasive shrub species such as Himalayan blackberry (*Rubus armeniacus*) and English ivy (*Hedera helix*); sword fern (*Polystichum munitum*) is also present, as described on the Tree Inventory, Figure T-1. Soils along the flatter sections of the project site are mapped as xerorthents, which are formed on tideflats and consist of sandy and loamy cut and fill material (USDA 2013a). Soils primarily along the slope are mapped as dystric xerochrepts (60 to 90 percent slopes), which are formed from colluviums and glacial till, and consists of very gravelly sandy loam (USDA 2013a). The soils are generally moist, as water seepage is common across the slopes. Due to the steep slopes, many of the alders are slanted and leaning over or toward West Bay Drive NW, most are thickly covered with English ivy, and some trees have dead tops.

Identified critical areas within the project site include the steep slope, and a Category III wetland (Wetland A) which requires an 80-foot (ft) buffer (Landau Associates 2013). Sections of the steep slope have been classified as landslide hazard areas per Section 18.32.605 of the OMC. This includes an unstable slope mass associated with a scarp (referred to as a landslide scarp) identified at the top of the steep slope near project stations 24+50 and 25+25, which extends down to West Bay Drive NW (Landau Associates 2014b).

PROJECT IMPACTS AND TREE PLAN

The project includes retaining walls, grading down slopes for slope stability, and using welded wire reinforcement over the landslide scarp.

Clearing and grading activities to support the sidewalk project will extend over 16 properties, under City and private ownership. Existing trees will need to be removed from the project site across multiple properties as shown on the tree protection plan Figures T-2 through T-6 and on Table 1.

Additional information regarding the slope stabilization, tree density requirements, and planting stock are provided below.

Slope Stabilization

Slope stabilization will generally include grading the slopes down; the landslide scarp will be stabilized using welded wire reinforcement. Prior to stabilization, the landslide scarp area will be cleared of vegetation (primarily red alder and English ivy); the red alder root mass will be left in place to provide soil stabilization. The landslide scarp will then be covered with a coconut fiber mesh followed by the welded wire reinforcement consisting of a 4" by 2" welded wire grid. The welded wire reinforcement will be secured using Hilfiker spiralnails in a grid-like pattern (Landau Associates 2014b). Retaining walls 1 through 4 will be installed at four locations for slope retention in addition to grading and welded wire reinforcement. The graded down areas will be planted with trees and shrubs; however, in order to maintain the strength integrity of the welded wire reinforcement, the welded wire grid pattern cannot be cut to create openings to allow the installation of plantings. In order to accommodate the slope stabilization and provide replacement trees (where possible), the following measures will be taken:

- Retaining in-place root systems of trees to be removed to provide soil stability; additionally, the root systems of younger deciduous trees may re-vegetate through coppice sprouting.
- Applying hydroseed at all disturbed areas
- Installing tree and shrub plantings within the graded down areas
- Removing hazard trees which are located along the slopes and currently have the potential to collapse and/or compromise the safety on West Bay Drive NW.
- Removal of invasive species such as English ivy and Himalayan blackberry.

- Plantings consisting of a diverse mix of trees/shrubs designed to provide slope stability and increase the habitat, diversity, and aesthetics along West Bay Drive NW.

Tree Density Requirements

As described in Section 16.60.080 of the OMC, the required minimum tree density is based on each parcel and its amount of buildable area. Tree density calculations, which include the conversion of tree to tree units based on diameter at breast height, are provided in the Urban Forestry Manual (City of Olympia 2013). The minimum tree density for developing and developed properties is 30 tree units per acre; however, because the project includes a right-of-way (ROW) that extends over multiple properties, the minimum tree density cannot be evaluated for each property. The code does not specify tree replacement requirements for sidewalk projects. For developed commercial/industrial/multifamily properties proposing an addition or other site disturbance, the requirement is: “...*replacement of one tree unit for every 500 square feet (sf) of disturbance and three tree units for every one tree unit proposed for removal, up to the minimum tree density of 30 tree units per acre for the entire site.*” As the project cannot take into account the minimum tree density per property, it is proposed that the required replacement consist of one tree unit for every 500 sf of disturbance and three tree units for every one tree unit proposed for removal, up to a minimum of 30 tree units per acre within the project site.

In accordance with the OMC 16.60.030, the removal of small trees with a diameter at breast height (dbh) of 6 inches or less are exempt from the tree plan and tree removal permit requirements. However, they can be used for tree credits. Additionally, hazard trees are exempt from the tree plan and tree removal permit requirements. Hazard trees are defined as “any tree with a combination of structural defect and/or, disease, (which makes it subject to a high probability of failure), and proximity to persons or property which makes it an imminent threat.” Hazard trees within the project site primarily consist of mature alders (some identified as being top dead) which are thickly covered with English ivy and leaning from the steep slopes over or toward West Bay Drive NW. These trees, even without soil disturbance, have a potential for failure (i.e., structural defect) and compromise the integrity and safety of the adjacent roadway.

The project site, which includes the amount of additional ROW for the sidewalks and slope stabilization, consists of 19,504 sf (0.45 acre) and the removal of 240 tree units. Tree replacement under the OMC 16.60.080 will require three tree units for every one tree unit removed, equaling 720 tree units, and one tree unit for every 500 sf of disturbance, equaling 39 tree units, up to a minimum of tree density of 30 tree units per acre. Since the OMC requires a minimum of 30 tree units per acre, the proposed project will require 15 replacement tree units for the 0.45 acre project site. The project will exceed this requirement with the installation of 50 replacement trees (not including trees to be installed in the Wetland A Buffer mitigation area) to be installed within the project site within areas where the trees will provide slope stability and trees will be placed in locations which should not damage the proposed

sidewalks or support infrastructure (i.e., planting trees adjacent to the proposed sidewalk) or be impacted by the welded wire reinforcement. An additional 83 native shrubs will be included in the plants to increase slope stability. In addition to the 50 replacement trees, approximately 27 street trees will be installed within the project's planting strips. Additionally this area is going beyond the code requirement since OMC 16.60.080 A requires 30 tree units per acre on the *buildable* area of the site. Per the OMC, the *buildable* area does not include city of ROW, critical areas and their buffers. The calculation of 0.45 acres includes critical areas, their associated buffers and ROW.

Planting Stock

As stated in the Urban Forestry Manual's planting stock and size requirements (City of Olympia 2013), the required minimum-sized replacement trees for commercial/industrial/multifamily sites in undeveloped locations are deciduous 1-inch caliper trees and 3-ft high conifer trees. Each replacement tree is worth one tree unit.

The areas to be replanted within the project site consist of undeveloped roadside, primarily on steep slopes. With the exception of the Wetland A buffer mitigation area, these areas will not be maintained once the project is completed, and tree maintenance such as irrigation, pruning, and tree staking will not be implemented. Larger plantings take longer to recover from transplanting shock, in which time the trees require high amounts of maintenance (Urban 2008). Additionally, larger root balls increase the amount of resulting soil disturbance, which will be damaging to the planting area; this is significant because most plantings will be installed on slopes in undeveloped areas (with the exception of the landslide scarp which will be secured with welded wire reinforcement). It is proposed that smaller tree stock (i.e., 1-gallon container plantings) be used for this project, and be considered one tree unit for this project, as these smaller plantings will quickly establish to site conditions, will require less maintenance, and have less of an impact to slopes during installation.

PLANTING SELECTION AND INSTALLATION

The area adjacent to West Bay Drive NW is primarily undeveloped and native tree and shrub species will be installed. The replanted areas will be highly visible to the public, from both vehicular traffic on West Bay Drive NW and foot traffic using the new sidewalk. Therefore, the tree and planting selections are designed to be diverse and aesthetically pleasing. Although red alders (*Alnus rubra*) are the dominate tree species in the project site, they are not included in the planting plan as they spread very readily by seed and it is assumed that they will re-colonize the project site from seeds of nearby trees and the seed bank in the existing soils. Additionally, the remaining root systems of younger red alders may re-vegetate through coppice sprouting. In addition to the installation of replacement trees, shrubs will be installed as understory vegetation to increase habitat value and soil stability. Planting areas will also be

hydroseeded with a native wildflower and grass mix in order to provide ground cover and increase site aesthetics.

Selection of reforestation species for each area is also based on:

- Versatility and adaptability to site conditions (moisture, sunlight, slope stability, soils)
- Known transplanting success
- Continuity with existing native vegetation and increase species diversity
- Ability to provide conditions to allow the volunteer establishment of native understory vegetation
- Habitat value
- Aesthetics over multiple seasons
- Availability.

The new plantings will greatly enhance the habitat, plant diversity, and aesthetics of the project site, which currently consists of a red alders and invasive species. Plant lists for each area are provided on the planting plan sheets (T-8 through T-12) and justification of selected species is provided in Table 1. Planting space will be dependent on site conditions, and plant installation will occur within the available space of the project site and within areas where soil disturbance associated with project construction has occurred. Trees will be planted 12 ft on-center spacing and shrubs will be planted 8 inches on-center spacing within the areas to be graded down, and trees will be planted 10 ft on-center within the Wetland A buffer mitigation area.

Plantings will be installed within the existing site soil, and will be mulched to assist with water retention. Invasive species, such as English ivy and Himalayan blackberry, will be removed from the planting areas during the clearing and grading activities. Removal may include herbicide application (glyphosate) in upland areas only, and will not be applied within wetland areas.

Plant Maintenance and Site Constraints

Irrigation is not recommended as part of this project. Irrigation on steep slopes can increase soil erosion, and if a break occurs in the irrigation line it could reduce soil strength due to saturation and slope failure. The project extends over multiple public and private properties which limit power and water access, and many of the plantings will be located on steep slopes and away from road access. The project site is an east facing slope and has been observed to contain water seeps and moist soils, indicating that adequate moisture will be available for plantings. In lieu of an irrigation system, the following steps will be taken to increase tree survival rates:

- Tree and shrub species selected for reforestation will be based on versatility and known transplanting success
- Planting will occur between October 1 and February 1
- Plantings will be mulched after installation to increase soil moisture retention.

Planting trees and shrubs within the landslide scarp to be secured with welded wire reinforcement is not recommended. The welded wire reinforcement contains 4" by 2" welded wire grid; in order to maintain the strength integrity of the welded wire reinforcement, the welded wire grid pattern cannot be cut to create openings to allow the installation of plantings. Although the grid can be "bent" to slightly increase the size of the opening, plant installation would still require cutting into the coconut fiber mesh, and there would be a very limited opening in which to create a planting hole. This would result in improper plant installation, increased damage to the plantings, and high plant mortality. Additionally, the welded wire can girdle and kill trees and larger shrubs as they grow. It is therefore recommended that the landslide scarp with the welded wire reinforcement be hydroseeded only.

WETLAND A BUFFER MITIGATION PLAN

Approximately 732 sf of soil disturbance and vegetation removal will occur within the outer buffer area of Wetland A in order to provide stabilization to the adjacent steep slope. Approximately 170 sf of the 732 sf area will consist of a 1:1 slope; due to the steepness of this slope, it is recommended that this area is hydroseeded only. The mitigation goal is to restore the tree cover lost from the vegetation removal. This goal will be accomplished by re-planting the remaining 562 sf of disturbed Wetland A buffer area with eight tree plantings in accordance with the planting selection and installation described above. The Wetland A buffer mitigation area planting plan is shown on Sheets T-9 and T-10 of the Tree Plan.

A monitoring plan will be implemented to document the success or failure of the mitigation for a period of 5 years from the date of the installation. The site will be specifically monitored for the survival of the planted material within the buffer restoration area. The following is a schedule of monitoring events and submittals to the City:

- Year 0: An as-built/year 0 monitoring report will be compiled and submitted to the City within 90 days of installation.
- Year 1 through Year 5: monitoring will be conducted between the months of July and October. Each year, a monitoring report will be submitted to the City within 60 days of the monitoring event.

Monitoring of the Wetland A buffer restoration area will be tied to performance standards in order to ensure the mitigation goal is met. The following performance standards are proposed for this project:

- 100 percent survival of planted material at the end of Year 1
- 80 percent survival of planted material at the end of Years 2 through 5.

Native volunteer tree species established in the restoration area will be counted in lieu of dead planted material. The monitoring methodology and establishment of monitoring stations will be determined during the Year 1 monitoring event. It is recommended that the maintenance of the wetland

buffer restoration area include hand irrigation or weeding if needed to meet the required performance standards. If the performance standards are met for each monitoring period and the success criteria is met at the end of Year 5, the project should be released from regulatory review and liability by the City. If performance standards are not met for any given year, planted material will be replaced as necessary. If a specific planted species fails to establish, then replacement plantings consisting of tree species native to the Thurston County area suitable for the mitigation site other than those identified in the planting plan may be used.

CONCLUSIONS

The proposed project will install sidewalks and planting strips along the west side of West Bay Drive NW. The OMC does not specify tree replacement requirements for developments such as public infrastructure, roads, and utilities which cross and include multiple properties and ROW. However, the proposed tree plan outlined in this report exceeds the tree density requirements provided in Section 16.60.080 of the OMC for the project site based on the interpretation of commercial/industrial/multifamily development standards, replacement of impacted trees, removal of existing hazard trees, and enhancement of the habitat and visual aesthetics of the project site.

JCS/TMT/jrc

REFERENCES

- City of Olympia. 2013. Urban Forestry Manual. Available at: <http://olympiawa.gov/~media/Files/CPD/Urban%20Forestry/Forms/Urban%20Forestry%20Manual.ashx>. Accessed May 15.
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- Landau Associates. 2013. Report: *Wetland Report West Bay Drive NW Sidewalks Project, Olympia, Washington*. Prepared for City of Olympia, Olympia, Washington. May 31.
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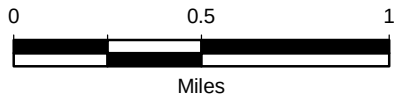
USDA. 2013b. *Plants Database*. United States Department of Agriculture, Natural Resources Conservation Service. Available at: <http://plants.usda.gov/java/>. Accessed May 15.

ATTACHMENTS

Figure 1: Vicinity Map

Table 1: Planting Justification

Attachment A: Level V Tree Plan



Data Source: ESRI 2008

West Bay Drive Improvements City of Olympia Olympia, Washington	Vicinity Map	Figure 1
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**TABLE 1
PLANTING JUSTIFICATION
WEST BAY DRIVE NW SIDEWALKS
OLYMPIA, WASHINGTON**

Trees		
<i>Acer circinatum</i>	Vine maple	A small, often multi-stemmed tree with a mature height of 20 ft. Commonly used as an ornamental due to its brilliant fall color and attractive form. This species has a high transplanting success rate and has a moderately deep root system.
<i>Acer macrophyllum</i>	Big leaf maple	Versatile species (wet to dry soils, full sun to shade), is an excellent pioneer species that tolerates poor soils conditions. Has a high transplanting success rate and relatively rapid grower. Its deep roots are good for stabilizing steep slopes. Matures to a large deciduous tree to 110 ft with a large spreading crown.
<i>Prunus emarginata</i>	Bitter cherry	Like ornamental <i>Prunus</i> species commonly planted in urban areas, bitter cherry is heavily covered with fragrant white flowers in early spring. It produces small fruits (cherries) eaten by small mammals and various birds. It can form a small tree reaching up to 30 ft, and establishes easy on disturbed moist areas.
<i>Rhamnus purshiana</i>	Cascara	A small tree with a mature height of 30 ft. Very versatile species (wet to dry soils, full sun to shade) that thrives in a wide range of conditions. Has a high transplanting success rate and is a relatively rapid grower. Small deciduous tree size (mature size is 30 ft) which diversifies habitat.
References: Sound Native Plants 2013, USDA 2013b		

TABLE 1
PLANTING JUSTIFICATION
WEST BAY DRIVE NW SIDEWALKS
OLYMPIA, WASHINGTON

Shrubs		
<i>Corylus cornuta</i>	Western hazelnut	Although this shrub is slower growing, it is a survivor, and produces edible wild hazelnuts.
<i>Holodiscus discolor</i>	Oceanspray	Very versatile shrub which produces elegant clusters of tiny flowers in the late spring.
<i>Mahonia aquifolium</i>	Tall Oregon grape	Very versatile and drought tolerant. An evergreen shrub with holly-like leaves which produces attractive clusters of deep yellow blooms in the spring and edible purple-grape like clusters in the summer.
<i>Rosa nutkana</i>	Nootka rose	A native rose which creates dense thorny thickets, and fragrant pink rose blooms. A versatile shrub which spread vigorously through suckers.
<i>Rubus parviflorus</i>	Thimbleberry	A versatile shrub with large, soft leaves. In the summer it produces large red "thimble-like" enjoyed by people and wildlife.
<i>Symphoricarpos albus</i>	Snowberry	Very versatile and spread vigorous through suckers once established, making it very popular for erosion control and steep slopes. Well known in the Pacific Northwest for its attractive persistent white berries during the winter.

References: Sound Native Plants 2013, USDA 2013b

**TABLE 1
PLANTING JUSTIFICATION
WEST BAY DRIVE NW SIDEWALKS
OLYMPIA, WASHINGTON**

Wildflowers		
<i>Achillea millefolium</i>	Yarrow	Yarrow is common throughout the United States, including Washington and Thurston County. It produces clusters of flattened dome-shaped white flowers. Establishes quickly in disturbed soils.
<i>Chamerion angustifolium</i>	Fireweed	Fireweed produces tall stalks covered with bright pink flowers. Very popular with pollinators. This native perennial quickly colonizes disturbed sites, such as those after a burn or logging.
<i>Clarkia amoena</i>	Farewell to Spring	Beautiful pink cup-shaped primrose that is commonly used in native wildflower mixes for bee and butterfly gardens. Farewell to spring is a readily self-seeding annual flower which can grow up to 3 ft tall. Native to Thurston County.
<i>Eschscholzia californica</i>	California poppy	Native to southern Washington, this wildflower is commonly used in mixes, often as part of erosion control in roadside plantings. It can be an annual or deep-rooted perennial. It readily colonizes disturbed sites.
<i>Lupinus polyphyllus</i>	Bigleaf lupine	Bigleaf lupine is a large perennial, sending out stalks of bright blue flowers in June-September which attract bees and hummingbirds. This native perennial is long lived, approximately 3 years, and can spread by seed.
Grass		
<i>Elymus glaucus</i>	Blue wildrye	Blue wildrye is a large native perennial bunchgrass which grows well in disturbed and undisturbed sites and tolerates wide variations in soil and conditions.
<i>Festuca idahoensis</i>	Idaho fescue	Idaho fescue produces an extensive, deep root system making it an excellent erosion control grass. It is a native perennial grass which grows on all exposures and under a wide variety of soil conditions.
<i>Festuca rubra</i>	Red fescue	Excellent soil stabilizer which is used extensively for stabilizing slopes, banks, and cuts. Long lived and spreads primarily through rhizomes.

Reference: USDA 2013b

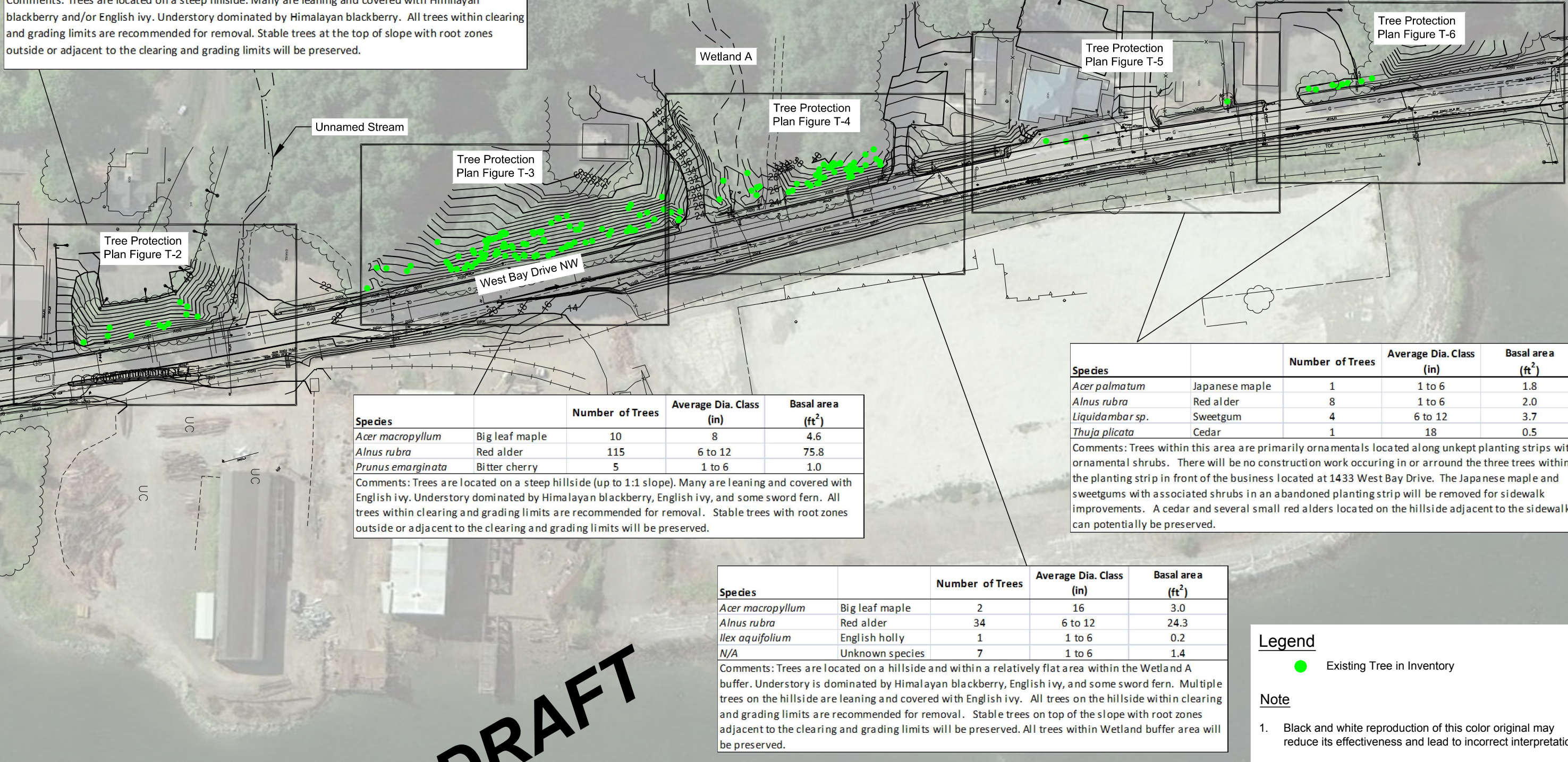
ATTACHMENT A

Level V Tree Plan

LANDAU ASSOCIATES, INC. | G:\Projects\258031\0201021\F_Tree Inventory.dwg (A) "Figure T-1" 3/21/2014

Species		Number of Trees	Average Dia. Class	Basal area
<i>Alnus rubra</i>	Red alder	16	6 to 12	10.2
<i>Crataegus douglasii</i>	Hawthorn	2	1 to 6	0.4
<i>Prunus emarginata</i>	Bitter cherry	1	6 to 12	0.3
<i>Pseudotsuga menziesii</i>	Douglas-fir	3	1 to 6	0.6

Comments: Trees are located on a steep hillside. Many are leaning and covered with Himilayan blackberry and/or English ivy. Understory dominated by Himalayan blackberry. All trees within clearing and grading limits are recommended for removal. Stable trees at the top of slope with root zones outside or adjacent to the clearing and grading limits will be preserved.



Species		Number of Trees	Average Dia. Class (in)	Basal area (ft ²)
<i>Acer macropyllum</i>	Big leaf maple	10	8	4.6
<i>Alnus rubra</i>	Red alder	115	6 to 12	75.8
<i>Prunus emarginata</i>	Bitter cherry	5	1 to 6	1.0

Comments: Trees are located on a steep hillside (up to 1:1 slope). Many are leaning and covered with English ivy. Understory dominated by Himalayan blackberry, English ivy, and some sword fern. All trees within clearing and grading limits are recommended for removal. Stable trees with root zones outside or adjacent to the clearing and grading limits will be preserved.

Species		Number of Trees	Average Dia. Class (in)	Basal area (ft ²)
<i>Acer palmatum</i>	Japanese maple	1	1 to 6	1.8
<i>Alnus rubra</i>	Red alder	8	1 to 6	2.0
<i>Liquidambar sp.</i>	Sweetgum	4	6 to 12	3.7
<i>Thuja plicata</i>	Cedar	1	18	0.5

Comments: Trees within this area are primarily ornamentals located along unkept planting strips with ornamental shrubs. There will be no construction work occurring in or around the three trees within the planting strip in front of the business located at 1433 West Bay Drive. The Japanese maple and sweetgums with associated shrubs in an abandoned planting strip will be removed for sidewalk improvements. A cedar and several small red alders located on the hillside adjacent to the sidewalk can potentially be preserved.

Species		Number of Trees	Average Dia. Class (in)	Basal area (ft ²)
<i>Acer macropyllum</i>	Big leaf maple	2	16	3.0
<i>Alnus rubra</i>	Red alder	34	6 to 12	24.3
<i>Ilex aquifolium</i>	English holly	1	1 to 6	0.2
N/A	Unknown species	7	1 to 6	1.4

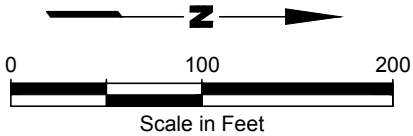
Comments: Trees are located on a hillside and within a relatively flat area within the Wetland A buffer. Understory is dominated by Himalayan blackberry, English ivy, and some sword fern. Multiple trees on the hillside are leaning and covered with English ivy. All trees on the hillside within clearing and grading limits are recommended for removal. Stable trees on top of the slope with root zones adjacent to the clearing and grading limits will be preserved. All trees within Wetland buffer area will be preserved.

Legend

● Existing Tree in Inventory

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



Google Earth Pro 2010; City of Olympia 2014

City of Olympia West Bay Drive Improvements Olympia, Washington	Tree Inventory	Figure T-1
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LANDAU ASSOCIATES, INC. | G:\Projects\258031020201\F_Tree Protection.dwg (A) "Figure T-2" 3/25/2014

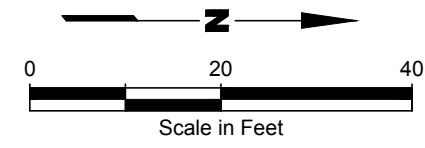


Legend

- 168 ● Surveyed Trees to Preserve
- 163 ● Surveyed Trees to Remove
- X—X— High Visibility Orange Fencing
- + + + Proposed Clearing and Grading Area
- ▨ Proposed Sidewalk Improvement

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



Google Earth Pro 2010; City of Olympia 2014



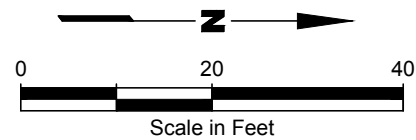
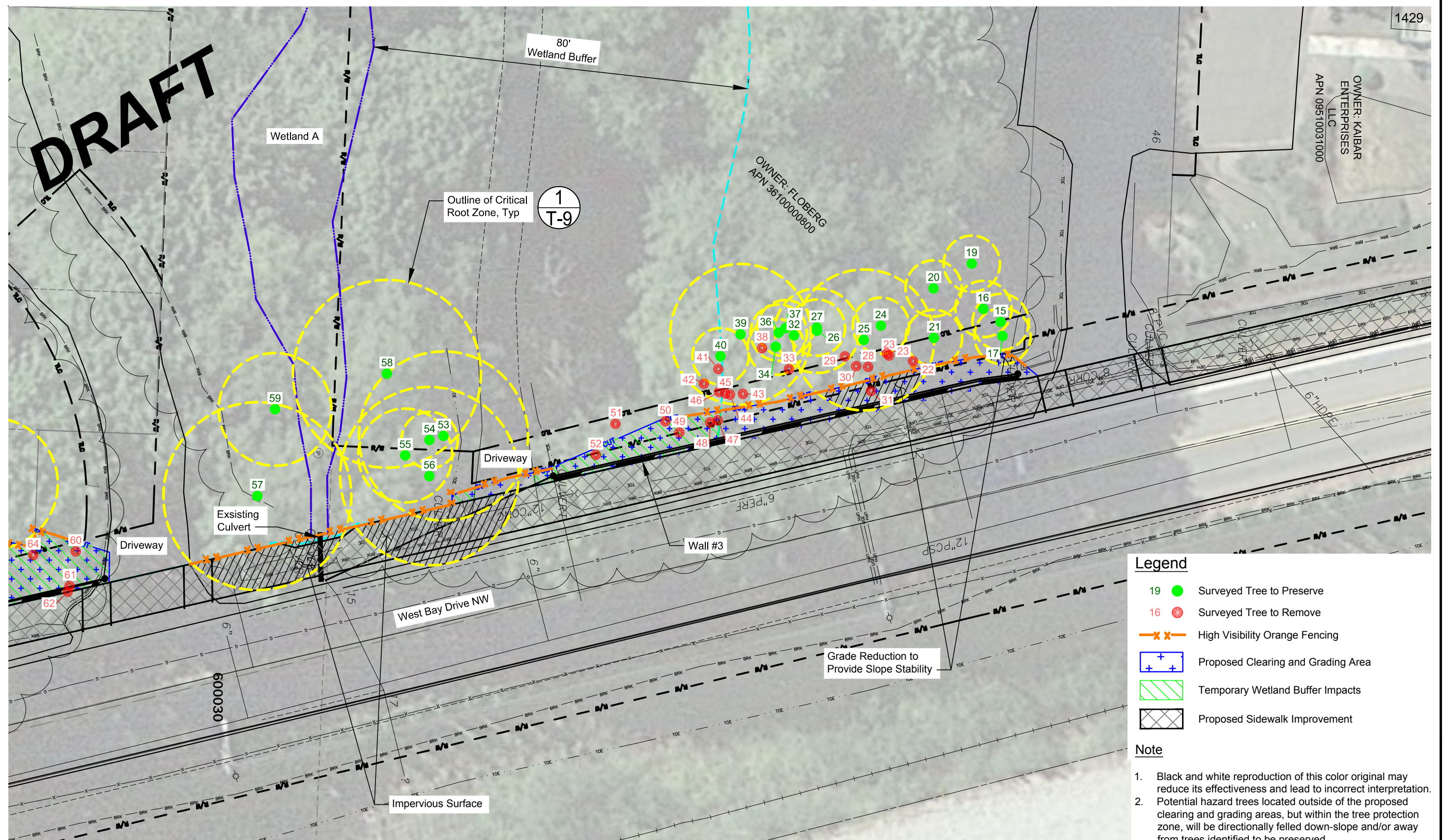
City of Olympia West Bay Drive Improvements Olympia, Washington	Tree Protection	Figure T-2
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City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Figure
T-3

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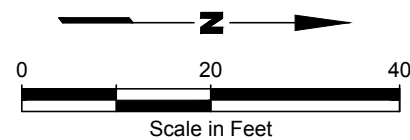


Google Earth Pro 2010; City of Olympia 2014

City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Tree Protection

Figure
T-4



City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Figure
T-5

DRAFT

OWNER: HARDEL
MUTUAL
PLYWOOD CORP
APN 09510024000

Trees and Shrubs Within Old
Planter Strip to be Removed

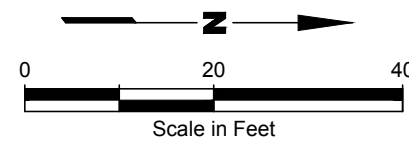
Wall #4

Legend

- Surveyed Tree to Remove
- + Proposed Clearing and Grading Area
- X Proposed Sidewalk Improvement

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

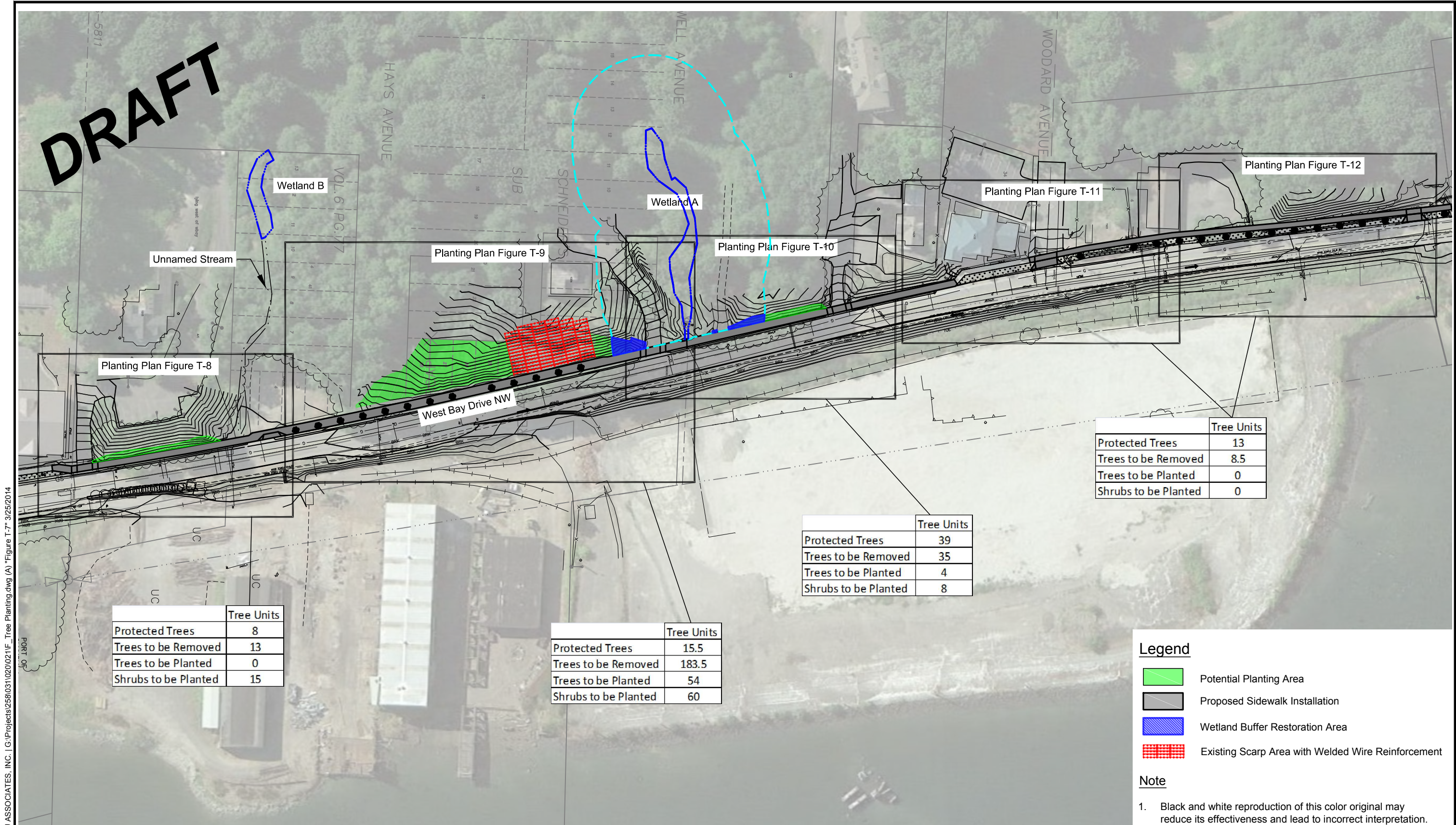


Google Earth Pro 2010; City of Olympia 2014

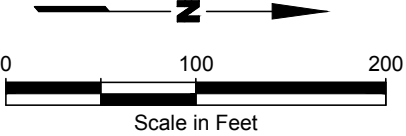
City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Tree Protection

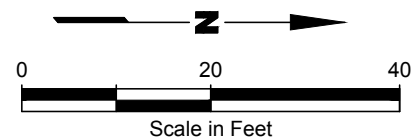
Figure
T-6



LANDAU ASSOCIATES, INC. | G:\Projects\258\031\020\021\Figures\T-7\T-7.dwg (A) "Figure T-7" 3/25/2014



Google Earth Pro 2010; City of Olympia 2014

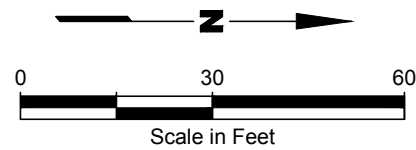
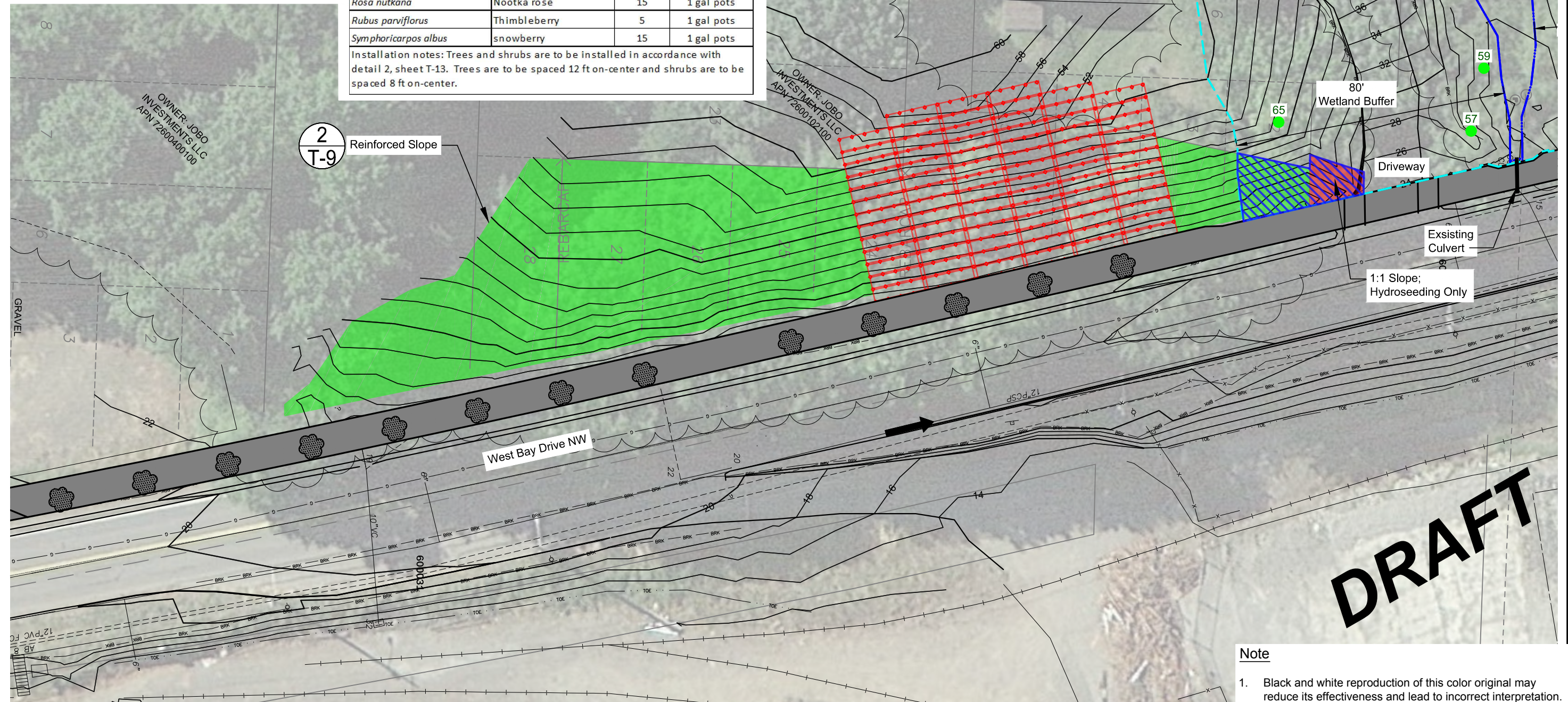


Legend

- 57 ● Surveyed Tree Preserved
- Potential Planting Area (7,090 SF)
- Proposed Sidewalk Installation
- Wetland Buffer Restoration Area (491 SF)
- Existing Scarp Area with Welded Wire Reinforcement (~4,000 SF)

Planting List - Potential Planting Area			
Tree Species		Specifications	
Scientific Name	Common Name	# of Plants	Size
<i>Acer circinatum</i>	Vine maple	20	1 gal pots
<i>Frangula purshiana</i>	Cascara	15	1 gal pots
<i>Prunus emarginata</i>	Bitter cherry	15	1 gal pots
Shrub Species		Specifications	
Scientific Name	Common Name	# of Plants	Size
<i>Corylus cornuta</i>	Western hazelnut	10	1 gal pots
<i>Holodiscus discolor</i>	Oceanspray	10	1 gal pots
<i>Mahonia aquifolium</i>	Tall Oregon grape	5	1 gal pots
<i>Rosa nutkana</i>	Nootka rose	15	1 gal pots
<i>Rubus parviflorus</i>	Thimbleberry	5	1 gal pots
<i>Symphoricarpos albus</i>	snowberry	15	1 gal pots
Installation notes: Trees and shrubs are to be installed in accordance with detail 2, sheet T-13. Trees are to be spaced 12 ft on-center and shrubs are to be spaced 8 ft on-center.			

Planting List - Wetland Buffer Restoration Area			
Tree Species		Specifications	
Scientific Name	Common Name	# of Plants	Size
<i>Acer circinatum</i>	Vine maple	3	1 gal pots
<i>Frangula purshiana</i>	Cascara	3	1 gal pots
Installation notes: Trees are to be installed in accordance with detail 2, sheet T-13, and spaced 10 ft on-center.			



Google Earth Pro 2010; City of Olympia 2014

City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Planting Plan

Figure
T-9

LANDAU ASSOCIATES, INC. | G:\Projects\258031020\021\F_Tree Planting.dwg (A) "Figure T-9" 3/25/2014

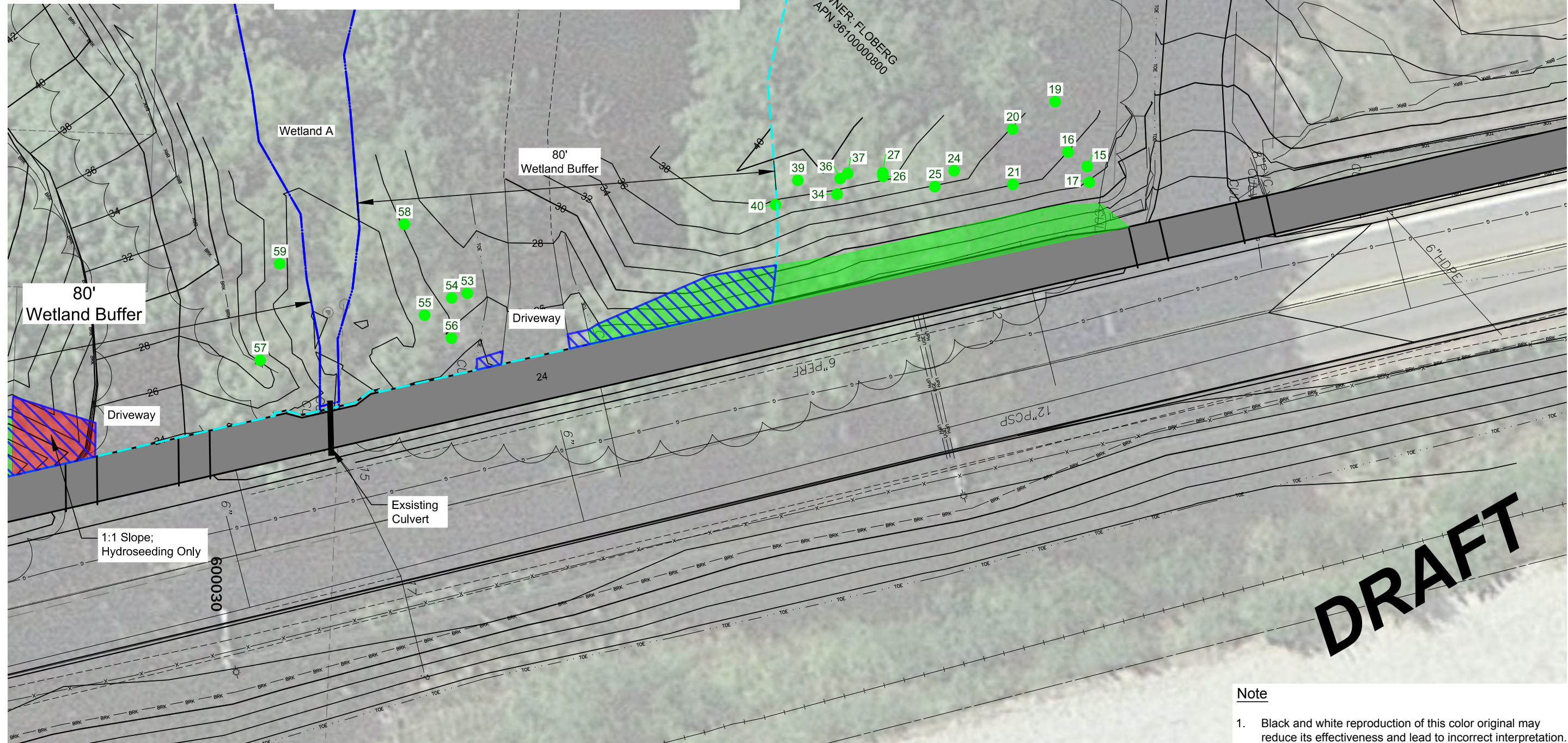


Legend

- 19 Surveyed Tree Preserved
- Proposed Sidewalk Installation
- Potential Planting Area (447 SF)
- Wetland Buffer Restoration Area (241 SF)

Planting List - Potential Planting Area			
Shrub Species		Specifications	
Scientific Name	Common Name	# of Plants	Size
<i>Holodiscus discolor</i>	Oceanspray	2	1 gal pots
<i>Rosa nutkana</i>	Nootka rose	2	1 gal pots
<i>Rubus parviflorus</i>	Thimbleberry	2	1 gal pots
<i>Symphoricarpos albus</i>	snowberry	2	1 gal pots
Installation notes: Shrubs are to be installed in accordance with detail 2, sheet T-13, and spaced 8 ft on-center.			

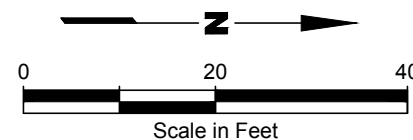
Planting List - Wetland Buffer Restoration Area			
Tree Species		Specifications	
Scientific Name	Common Name	# of Plants	Size
<i>Acer circinatum</i>	Vine maple	2	1 gal pots
<i>Frangula purshiana</i>	Cascara	2	1 gal pots
Installation notes: Trees are to be installed in accordance with detail 2, sheet T-13, and spaced 10 ft on-center.			



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES, INC. | G:\Projects\258031020\021\F_Tree Planting.dwg (A) "Figure T-10" 3/25/2014



Google Earth Pro 2010; City of Olympia 2014

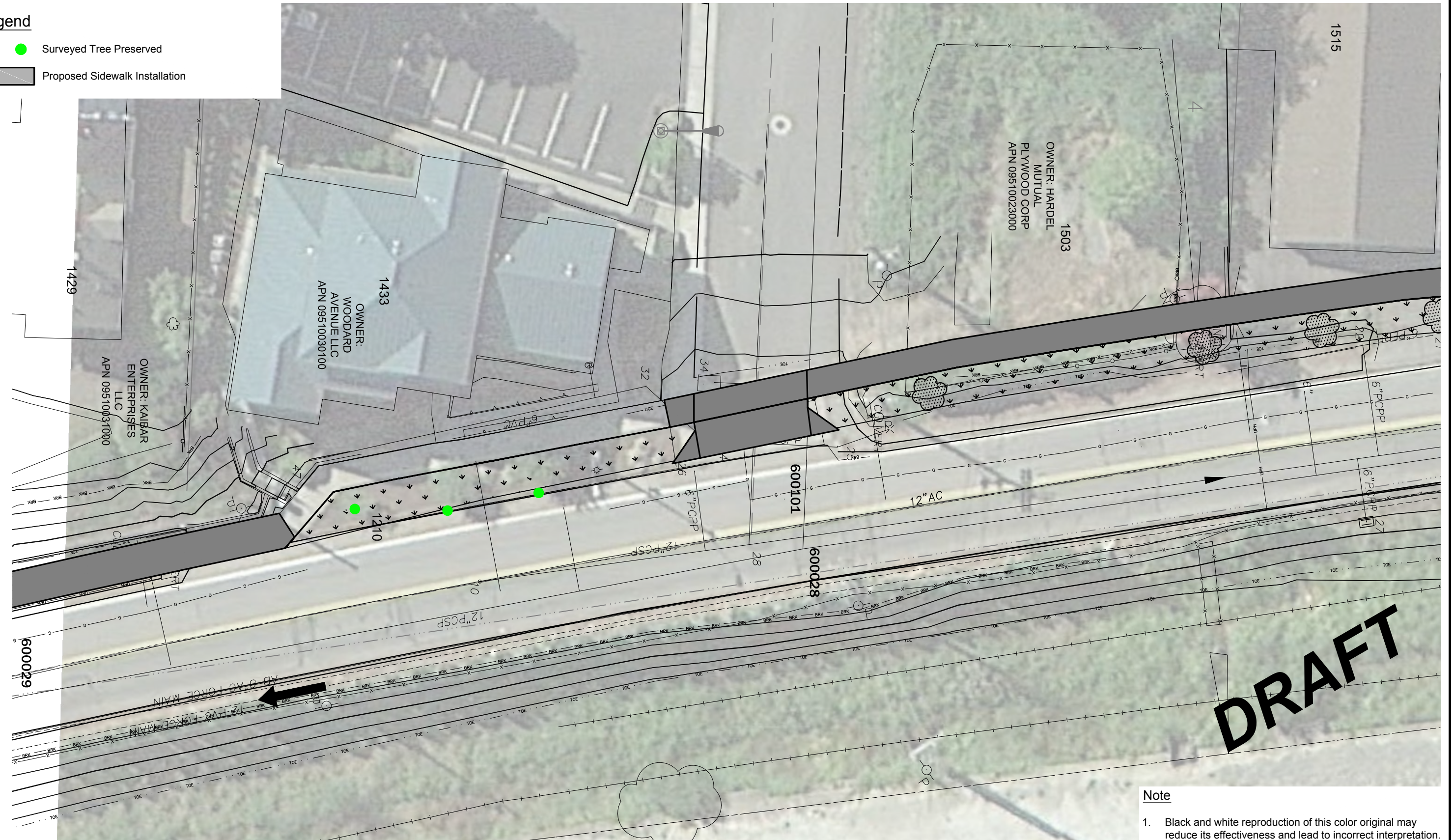
City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Planting Plan

Figure
T-10

Legend

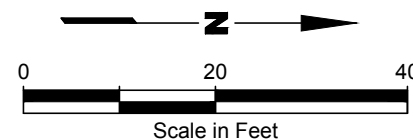
- Surveyed Tree Preserved
- Proposed Sidewalk Installation



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Note

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Google Earth Pro 2010; City of Olympia 2014

City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Planting Plan

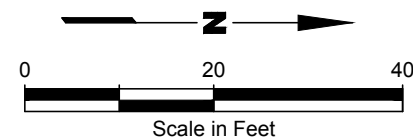
Figure
T-11

LANDAU ASSOCIATES, INC. | G:\Projects\2561031020\021\F - Tree Planting.dwg (A) "Figure T-12" 3/25/2014



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

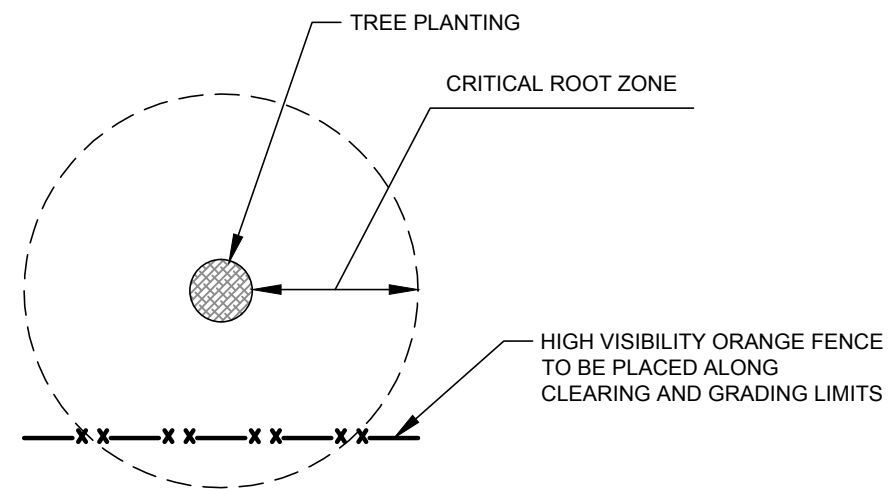


Google Earth Pro 2010; City of Olympia 2014

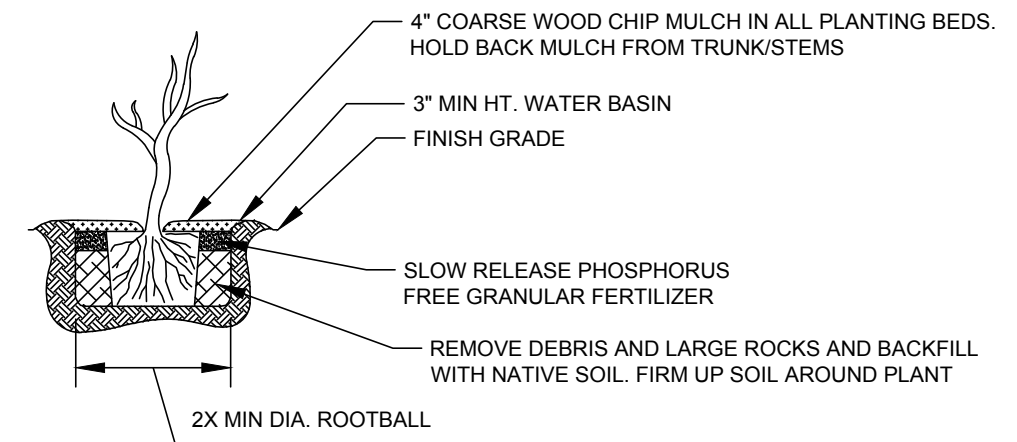
City of Olympia
West Bay Drive
Improvements
Olympia, Washington

Planting Plan

Figure
T-12



1 TREE PROTECTION DETAIL



NOTES

1. PLANTING HOLE SHALL NOT BE LESS THAN 2 TIMES THE WIDTH OF THE ROOT BALL DIAMETER.
2. LOOSEN SIDES AND BOTTOM OF THE PLANTING HOLE.
3. REMOVE TREE FROM POT AND ROUGHEN ROOT BALL. DO NOT INSTALL TREES WHICH ARE ROOT BOUND OR CONTAIN CIRCLING ROOTS.
4. SOAK PLANTING HOLE WITH WATER AFTER TREE INSTALLATION.

2 TREE PLANTING DETAIL
(NON SLOPE STABILIZED AREAS)

DRAFT