Seattle Public Utilities, Lakeridge Park

Taylor Creek Restoration Project
Tree Impact Assessment

PREPARED FOR:

Cody Nelson
Seattle Public Utilities
Seattle, WA 98026

PREPARED BY:

Anna Heckman
ISA Board Certified Master Arborist,
Municipal Specialist
Tree Risk Assessment Qualified
ASCA Tree and Plant Appraisal Qualified
aheckman@bartlett.com

Tyler Holladay, Consultant
ISA Certified Arborist #PN-8100A,
ISA Tree Risk Assessment Qualified

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company

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The wide trail leading up Dead Horse Canyon in Lakeridge Park

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Summary

Seattle Public Utilities (SPU) is in the process of evaluating potential options for installation of large woody material (LWM) within the Dead Horse Canyon portion of Taylor Creek. Two of the options would require a temporary access road through the forest to install the LWM. This proposed temporary road would parallel the Dead Horse Canyon trail adjacent to Taylor Creek. Urban Forestry Services | Bartlett Consulting (UFS|BC) was contracted by SPU in the summer of 2022 to identify and assess the condition of trees within the proposed temporary road alignment and in the surrounding road buffer to provide guidance for tree retention and protection.

After the initial assessment was completed, SPU requested a comparison of the trees to be potentially impacted between two design options. Design option 1 is the original plan provided for the assessment. This option proposes installing the full-length temporary access road up the canyon with a spur road (~2700 feet). Option 3 proposes installing a partial length temporary access road about 1250 feet (halfway) up the lower canyon in the same location as Option 1. Since the original production of this document, SPU has removed Option 1 from consideration in response to community feedback and preferences for limiting tree impacts.

The forest surrounding the Dead Horse Canyon trail consists mostly of deciduous bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*) and many younger western redcedars (*Thuja plicata*). Large old cedar, maples, and western hemlocks (*Tsuga heterophylla*) are located just outside the existing trail over the sewer alignment.

522 trees were identified and assessed for this project. 305 of them are over 6 inches diameter. Many trees in the forest are in fair condition but have poor structure such as uncorrected leans and exposed shallow root systems. The tall and thin structure of the alders and maples that are competing for light and space in the upper canopy also contribute to the natural thinning of this forest stand. The larger conifers in this forest have good structure, but many show signs of long-term stress and decline. Almost all the western hemlocks are classified as snags. The direct and indirect causes for the hemlock decline was not investigated for this assessment but the observations are not abnormal to what we have observed in other northwest urban forests. Nearly all the large older big leaf maples have signs of wood decay and are hollow but still have full crowns. These larger diameter maple trees are 20 feet shorter than the upper forest canopy and more structurally stable than many of the taller, younger, smaller diameter maples. These larger older trees will continue to provide excellent wildlife habitat if they can be retained.

In areas where slope movement was observed most of the trees have pistol butts and roots growing up the slope to anchor the tree to the hill. This root adaptation requires changes to the standard tree protection zone recommendations. Trees on the uphill side of the proposed road

can have the road built very close to the trunk and may only require trunk protection while trees on the downhill side of the road will require a greater root protection area to fully protect the trees. Temporary road surfacing can be designed to bury roots on the uphill side, however root cutting is discouraged uphill of any trees prioritized for retention.

The design for the walls proposed to secure the temporary road in some of the steeper canyon areas requires soil excavation to create a flat wall base. This excavation will impact many trees on the slope within the buffer below the road. 33 trees were identified in the buffer to have a higher preservation value (Table 5). An assessment of alternative wall designs and installation methods to decrease root impacts are encouraged near these trees. After tree retention decisions are made, all to be retained should have tree protection plans developed and incorporated into the project design.

Very few trees (11) located on the road alignment were identified as having a high preservation value (Table 3). These trees are identified in Appendix III and recommended for closer assessment for retention. Road realignment will be required to retain any of these trees.

Of the 205 trees over 6 inches diameter located within the road buffer, 25 are in an active state of failure with leans over the trail and potential work zones. If these trees have not fallen to the ground before construction begins, they should be dropped and retained on site to reduce the risk for construction workers on site (Table 4). These trees are identified in the retention recommendations as “nonviable”. The remaining trees are proposed for retention at this time even though many located on the downhill side of construction will likely have impacts that will cause them to fall into the creek during or shortly after construction.

In comparison to Option 1, Option 3 is just under half the length of road as Option 1, and the reduction in impacts are similar.

- 47 instead of 100 trees would be removed within the temporary road alignment.
- 88 instead of 205 trees would be removed in the buffer surrounding the road.
- 26 instead of 54 exceptional trees in the alignment and buffer would be impacted.
- 94 instead of 218 small trees (<6 inches) would be removed.

Similar to Option 1, the trees in Option 3 are mostly deciduous and less than 18 inches diameter, and the small trees less than 6 inches diameter are mostly conifers.

The geodatabase which includes all the individual tree information was provided to the city at the time of publishing this report for use in future planning and design. The Tree ID column was used to partner all UFS| BC data with the existing geodatabase. Only summary tables and graphs can be included in this report to reflect the data for over 827 trees. The understory vegetation richness, canopy coverage and details on soil, and large woody debris will be provided in a separate *Preconstruction Vegetation Assessment Report*.

Introduction

Seattle Public Utilities (SPU) is evaluating potential access options to install large woody material (LWM) within the mainstem of Taylor Creek in Dead Horse Canyon region of Lakeridge Park. Access options include a proposed temporary road alignment that parallels and follows an existing trail located within a utility easement for a 10-inch diameter gravity-fed sewer line through the canyon. This easement and the sewer line are managed by SPU. Lakeridge Park is managed by Seattle Parks and Recreation (SPR) and has an active neighborhood volunteer base that works to improve the park area as part of the Green Seattle Partnership.

Urban Forestry Services | Bartlett Consulting (UFS|BC) was contracted by SPU in the summer of 2022 to provide a third-party unbiased assessment for the condition of the trees associated with the proposed stream restoration project and to provide an opinion on the construction impacts to these trees associated with the proposed temporary access roadway to assist both SPU and SPR in project decision making.

SPU requested evaluation of two access options. The first design (Option 1) includes an approximately 2,460-foot-long temporary access road that generally follows the existing trail along the west slope of the ravine between Holyoke Way S and the confluence of the east and west forks of Taylor Creek. The access road crosses the creek then follows the trail alignment along the east slope of the ravine before terminating on the south side of the east fork. This option also includes a 240-foot-long temporary spur road that follows a portion of the trail alignment along the east slope of the ravine. (Appendix III)

The second option (Option 3) includes a temporary access road that follows the same alignment as the proposed Option 1 but will terminate approximately 1,250 feet south of Holyoke Way S, or before the first pedestrian bridge on the west slope of the canyon.

For the purposes of this Tree Impact Assessment, the description and impacts are focused on Option 1, full road alignment with general comparisons with Option 3. Since this study was commissioned, SPU has removed Option 1 from consideration due to community and stakeholder feedback. The tree impact assessment and recommendations can still be applied to Option 3, which follows the same alignment as Option 1, but is shorter in length,

Assignment

UFS|BC was asked to assess inventoried trees within the identified construction impact zone for the proposed temporary access road and provide an assessment of how the trees may be impacted by the proposed temporary road. SPU provided a surveyed inventory of trees over 6 inches in diameter within the proposed construction area (road alignment and buffer). The following details were requested for this assignment:

1. Identify trees over six inches diameter and exceptional trees as defined by City of Seattle Department of Construction and Inspections' Directors Rule (DR) 16-2008 within the proposed construction area and provide an assessment of tree health, structure, and an opinion of relative preservation value. Any additional trees greater than six inches diameter in size and considered high preservation value that are located outside the buffer that may be impacted by the proposed construction were also included.

2. Identify, map and assess smaller trees less than six inches diameter within the proposed road alignment and buffer. These trees were not included in the SPU survey inventory. Many were likely planted for forest restoration are of high value to the volunteer community.
3. Using the construction plans provided for construction option 1, identify trees that will likely be impacted and trees that will require removal for the proposed construction and adjacent buffer area, and identify trees of high value that may require construction adaptations for protection.
4. After the original data were collected, SPU requested UFS|BC to provide a comparison between construction options 1 and 3. Where Option 3 extends along the same alignment as Option 1 but stops at approximately 1250 feet south of Holyoke Way.
5. All data are provided in an Arc GIS geodatabase to the city for further assessment and planning.

Limits of the Assignment

The tree assessment was performed from the ground to observe visual conditions. Care is taken to obtain all information from reliable sources. All data has been verified; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Illustrations, diagrams, graphs, and photographs in this report, are intended as visual aids, are not to scale and should not be construed as engineering or architectural details or surveys. Information contained in this report covers only those items that were identified and examined and reflects the condition of those items at the time of inspection. There is no warranty or guarantee, expressed or implied, that problems or deficiencies with the trees in question may not arise in the future. There is no guarantee of the preservation of the trees identified in this report.

It is important for the tree owner or manager to know and understand that all trees pose some degree of risk from failure or other conditions. The information and recommendations within this report have been derived from the level of tree risk assessment identified in this report, using the information and practices outlined in the International Society of Arboriculture's Best Management Practices for Tree Risk Assessment and the American National Standards Institute A300 Tree Risk Assessment Standard, as well as the information available at the time of the inspection. However, the overall tree risk rating, the mitigation recommendations, or any other conclusions do not preclude the possibility of failure from undetected conditions, weather events, or other acts of man or nature. Trees can unpredictably fail even if no defects or other conditions are present. Tree failure can cause adjacent trees to fail and result in a "domino effect" that impacts targets outside the foreseeable target zone of this tree. It is the responsibility of the tree owner or manager to schedule repeat or advanced assessments, determine actions, and implement follow-up recommendations, monitoring, and/or mitigation.

Bartlett Tree Experts can make no warranty or guarantee whatsoever regarding the safety of any tree, trees, or parts of trees, regardless of the level of tree risk assessment provided, the risk rating, or the residual risk rating after mitigation. The information in this report should not be considered as making safety, legal, architectural, engineering, landscape architectural, land surveying advice, or other professional advice. This information is solely for the use of the tree owner and manager to assist in the decision-making process regarding the management of their tree or trees. Tree risk assessments are simply tools that should be used in conjunction with the owner or tree manager's knowledge, other information and observations related to the specific tree or trees discussed, and sound decision making.

Methods

Subject trees six inches in diameter and larger within the study area were tagged and identified by SPU in the spring of 2022. This tree information was provided in GIS database map layer format for evaluation. These layers contain 301 tree data points located within the proposed construction limits (including the buffer area) with 102 of these trees located within the proposed road alignment. A GIS topographic overlay consisting of topography, the proposed road centerline, road alignment and a road buffer were provided for field data collection.

All trees were evaluated using the ArcGIS Collector application on a tablet. The data collection entries were designed to meet the specifications identified in the next section. Information for each tree was documented and provided in the GIS file geodatabase.

Site visits for data collection occurred throughout July and August of 2022. During the site visits, trees identified within the proposed road alignment, road buffer or otherwise likely to be impacted by the proposed construction that were not on the survey were provided with an approximate location using the topographic information and the location of surrounding surveyed trees. Un-surveyed trees larger than six inches diameter are labeled as unmapped (UM), and trees smaller than 6” are labeled as not surveyed (NS) in the geodatabases developed by UFS|BC.

Only six trees from the data points provided were not positively located during field assessments. These may be identified as unmapped (UM) trees because they were missing tags, or these trees had fallen over prior to the assessment and were not positively identified.

Multiple stem trees were consolidated to one Tree ID point. The tree tag numbers and information for the additional stems were documented in this single data point and the additional stems identified in the survey provided were documented with zero diameter and referenced to the single Tree ID. Additional stems are not counted or referenced further in this analysis.

Trees less than six inches diameter within the proposed construction limits were identified and provided with a size classification and general health assessment. These trees were not tagged in the field.

Construction documents were analyzed and compared with the field tree assessment findings. Recommendations provided reference the 90% Dead Horse Canyon Ravine Stabilization and Sediment Storage Design pages provided for review.

Specifications and Definitions

Location (GPS (Global Positioning System) latitude / longitude coordinates): We collected individual tree location and attribute data using the provided locations with smart phone and tablet devices using manual touch-locate collection and adjustment methods using aerial imagery base maps. The GPS devices we use have an error-in-location potential of ± three meters in this site and were not used.

Species: Tree genus and species were identified. Common names vary between different inventories. Where species look like they were hybridizing, notes were made to identify character traits.

Size: DSH (Diameter at Standard Height), approximate dripline, and approximate height): Diameters were measured at 4.5 feet above the ground (DBH). Measurements were taken above bulges or large flares where possible using diameter tape and measured to a 10th of an inch. Multi stem trees were calculated using the Quadratic Mean Diameter method that can be referenced in the City of Seattle Director's Rule16-2008 and the ISA Best Management Practices. Trees over 6" diameter are defined as larger trees in this report.

Heights were measured using a Nikon Forestry Pro 2 laser hypsometer and visually estimated when laser measurement was not obtainable. All heights were rounded to the nearest 10-foot increment.

Circular driplines were measured from one side of each tree using a laser measuring device from the approximate edge of the crown. Trees with non-circular or uneven driplines crowns were measured and estimated from each cardinal direction.

Exceptional Tree: Per the Seattle Director's Rule 16-2008, trees over 30-inch diameter and meeting standards for habitat diversity, uniqueness, or potentially historic specimens were identified as Exceptional. Trees that may be exceptional in size that are dead, diseased or considered high risk that can be mitigated to reduce risk, were retained in Exceptional status for this assessment. Any alders, cottonwoods or cherries would also be considered exceptional as this forested area can be considered a single grove.

Exceptional Tree groves were not prioritized in this assessment. This whole forested area consists of a continuous canopy and most trees exceed the 12" diameter threshold. Any construction activities in this forest will impact portions of the forest grove.

Condition (Vigor, Structure, Form):
All conditions are rated on a one to five categorical scale from Poor (1) to Good (5). This scale follows the American Society of Consulting Arborists (ASCA) plant appraisal tree condition tables (Appendix 4).

Vigor considers over all tree health, including annual branch increment growth for the species, leaf density and size and canopy form and density. Vigor is the health of the tree as well as an assessment of a tree's ability to recover from damage. The scale for Vigor includes a 0 rating for dead trees that are considered a snag.

Structure accounts for root, trunk and branch balance and stability. Observations such as wood decay fungi, cracks, reaction growth, leans and height to diameter ratios (including rate of taper) impact structure.

Form accounts for the balance, size, unique shape and the contribution the tree makes to the surrounding environment and landscape.

Habitat Trees/Snags: Dead or living decaying trees were documented as snags. Classifications for snags followed the Green Seattle Partnership Forest Monitoring Manual provided by Seattle Parks and Recreation. Snags were often recommended for removal or height reduction to retain at an acceptable level of risk near construction areas.

Tree Risk Assessment Rating: All trees are provided with a Level One Limited Visual Risk Assessment using current ISA TRAQ (Tree Risk Assessment Qualified) standards (Appendix 4). Targets considered were park users on the trail and expected construction workers and equipment. Where targets exist, and the tree has defects contributing to a high likelihood of failure, and the direction of failure is predictably toward the target, trees were recommended for mitigation to reduce risk. For this site, tree removal or height reduction is recommended. All trees should be monitored after significant weather events and reassessed again after construction.

Preservation Value: This subjective rating of *low, medium* or *high* is based on our professional opinion of uniqueness or longevity of a tree using its size, condition, age, form, location, species characteristics, unusual features or its contribution to protecting other trees. Preservation value ratings for a tree in a forest environment will be different than the same tree in a high-density residential area. Tree preservation value is not a construction plan retention recommendation. Most trees in good condition are rated as a medium preservation value.

Tree Protection Recommendations: Using the tree size, condition, species, and location relative to construction, retention and removal recommendations are provided. Recommendations were kept general and consist of the following categories:

- Retain: These trees should be retained at this time.
- Retain with Treatment: These trees may require pruning, adjustments to the design in the field, or height reduction to retain. All trees in this category should be monitored through construction for safety.
- Remove for Risk: These trees are in the process of failure and are located over the current trail and should be managed for park safety despite construction.
- Remove-nonviable: These trees have already failed or will likely fail soon but are not a high risk to the public.
- Remove for Construction – Without major redesign, these trees will require removal for the construction of the proposed road.

Critical Root Zone, Tree Protection Zone: All maps in this report identify a Critical Root Zone equivalent to six times the diameter of the tree trunk. This is a general recommendation used for minimum planning purposes to retain tree stability (Appendix 4). Actual root zones will vary based on tree health and structure, and soil properties. Trees identified to have a high protection value should be individually assessed. Unlike many construction areas where drip lines are used for root zone assessment, in a forest environment individual tree driplines are uneven and are not a good reflection of the root systems. The Tree Protection Zones on this site should be set and maximized in the field. These Tree Protection Areas will differ from what is calculated on the map based on the topography of the site.

Forest Inventory Measurements and Observations

The trees assessed for the proposed road impact are located around the existing Lakeridge Park/Dead Horse Canyon trail. This trail follows an existing sewer line up the west side of the steep canyon slope. This trail crosses small wetlands and intermittent streams that run down slope into Taylor Creek.

The deciduous overstory tree canopy is consistent in height near 80 to 100 feet with very little forest canopy layering (Appendix 1; Photos 16-18). This deciduous canopy allows light in the winter through to the understory.

During the tree assessment many areas with exposed bare soil and very little soil organic matter were observed. This is surprising given the extensive deciduous canopy cover and large amounts of annual leaf litter falling to the ground each year that does not seem to accumulate in the soil. In many areas soil erosion was observed under tree trunks on the downhill side of trees. In other areas roots are growing on top of the existing soil grade. Throughout the whole assessment area many trees located on slopes had pistol butt formations (Photo 7) with roots growing up slope anchoring the trees to the hill. All these observations corelate and contribute to an actively moving or eroding slope.

The midstory canopy and shrub layer in this forest is very diverse with many native plant species and many smaller cedar trees growing close together. Some of these trees and plants, though native to the region, were planted for forest restoration or project mitigation purposes and not natural regeneration. Remnant patches of English ivy indicates this west side of the canyon may at one time have been more like the poorly accessible east side of the canyon which has large patches of English ivy and blackberry visible throughout. These general forest observations will be presented in greater detail in UFS/BC's accompanying *Pre-construction Vegetation Assessment Report*.

The proposed temporary road alignment is designed to parallel the existing Dead Horse Canyon Trail using the disturbed flat areas. On steeper slopes, the temporary road alignment will have removable walls installed to support the road on the downslope side. Further up the canyon, the proposed road then moves to the uphill side of the existing trail and parallels the upstream bridge with a temporary creek crossing.

The construction of the previous sewer line and the management for the existing Dead Horse Canyon trail has impacted the forest composition within the local area surrounding the existing trail (Appendix 1; Photo 1-3, 10-12). Trees closest to the trail are smaller and younger and mostly consist of young, planted trees and primary successional tree species that naturally established after the sewer line installation. The difference between the forest along the trail and at the edge of the trail can be seen when we compare the trees that would be directly impacted within the proposed road alignment to those trees located around the edge of the alignment.

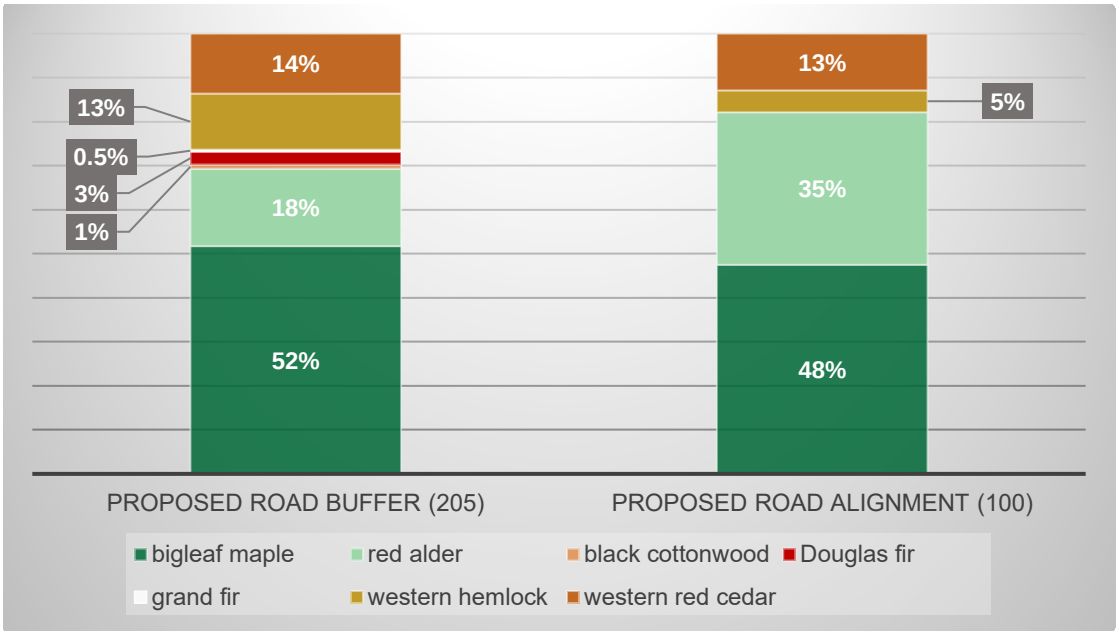
For this project 305 trees over six inches diameter were documented within the construction impact area of the full-length temporary access road (Option 1). Some of the tree points provided in the survey were part of multi-stem trees. These 37 points are not counted toward the final tree count. Six tree points in the survey were not found on site and 55 trees that were not previously identified (UM) were identified within the proposed road alignment and buffer area. In total, 100 trees were assessed within the proposed road alignment and 205 trees were assessed in the identified buffer to the temporary road alignment. 217 smaller trees (less than

six inches) were also identified within the proposed construction area. The following analysis compares the trees assessed within the proposed road alignment vs. those within the buffer of the proposed road for the full road identified as Option 1.

Tree Species Richness

The forest overstory is dominated by bigleaf maple (*Acer macrophyllum*) consisting of half the trees measured. Patches of red alder (*Alnus rubra*) are located near wetter areas. The red alder was slightly more abundant on the proposed road alignment than in the buffer. (Appendix 1; Photo 10, 11, and Figure 1). Large old conifers speckle the forest canopy further from the trail and the previous sewer line disturbances and very few conifers are located in the alignment. Very few (4) conifers over 6 inches were identified within the proposed road alignment. These are all exceptional in size and many smaller (<6 inch) very young cedar trees (*Thuja plicata*) are growing near the trail, both on and off the proposed road alignment (Figure 2, Appendix 1)

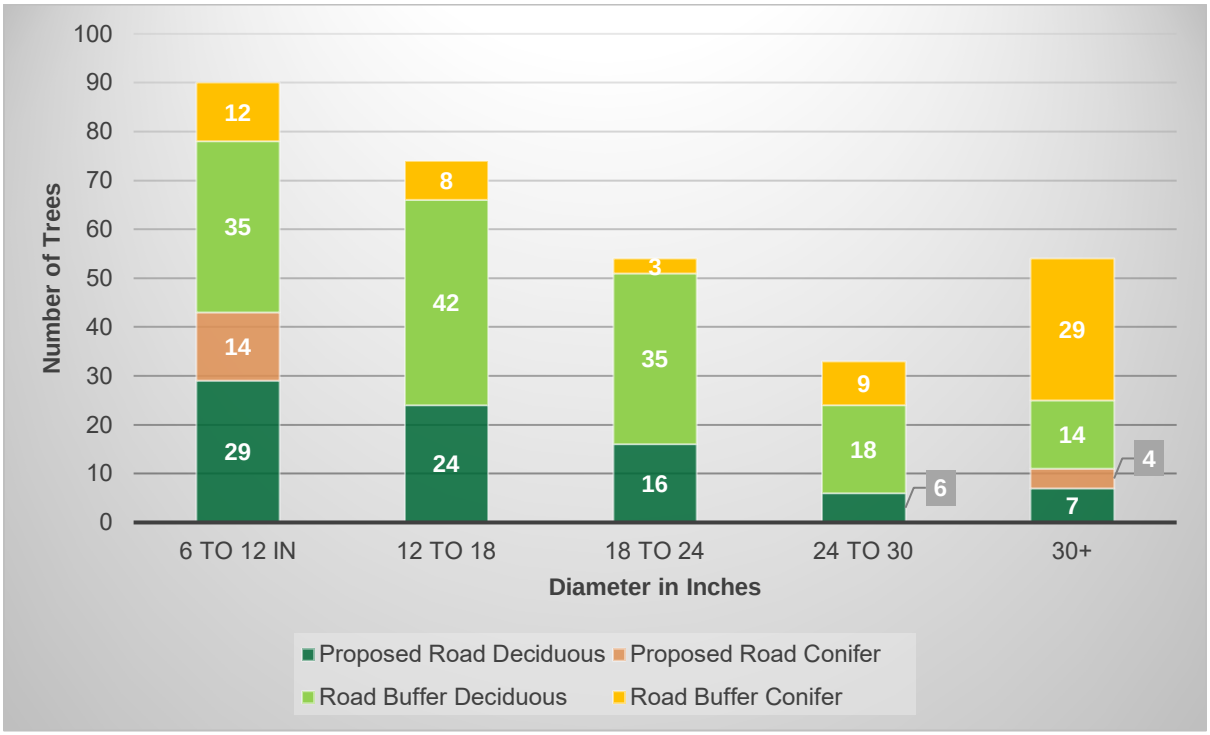
Figure 1: Species Richness for trees >6 inches Within the Proposed Road Alignment and Road Buffer.



Tree size

The trees larger than six inches diameter that are growing back naturally after the sewer line installation or planted in connection with the GSP volunteers, are smaller on average than those located further away from the trail (Figure 2). A few large trees are located around the proposed road and construction area, however most of the largest and oldest trees are located closer to the creek or above the eroded banks where previous disturbance and erosion has been low further from the proposed road (Map 3).

Figure 2. Tree Diameter Class Distribution



Exceptional Trees

In Seattle, many species of trees over 30 inches in diameter may be considered Exceptional. Exceptional trees are often very old trees that can take multiple generations to replace. For the 305 surveyed trees in this inventory, 54 (20%) were larger than 30 inches in diameter (Map 3., Appendix 1). Most of these trees are old western red cedar and bigleaf maple. These trees provide habitat value, and a strong local genetic seed source. The exceptional trees in good condition are prioritized for retention in this assessment. Map 3 shows the location of the trees over 30-inch diameter relative to the proposed road alignment.

The Critical Root Zone equivalent to six times the trunk diameter is included on the maps to communicate the protection area most of these trees need to retain stability on the slope. In an urban or landscape environment, these trees would have a CRZ set at 12 times the diameter. In this forest environment impacts are set to only one side of any particular tree. Some trees can be retained with minimal damage, and some trees will require design adaptations such as moving temporary walls or minor road realignment. Of the 54 Exceptional trees, 11 are located within the proposed temporary road alignment for Option 1 (Table 1). These trees will likely require removal unless redesign of the alignment or construction methods occurs. One red alder (tree 1046) within the proposed construction area is larger than 30 inches but has poor structure and is in very poor condition and therefore not considered Exceptional due to size.

Table 1. Exceptional Trees Located within the Proposed Road Alignment for Option 1.

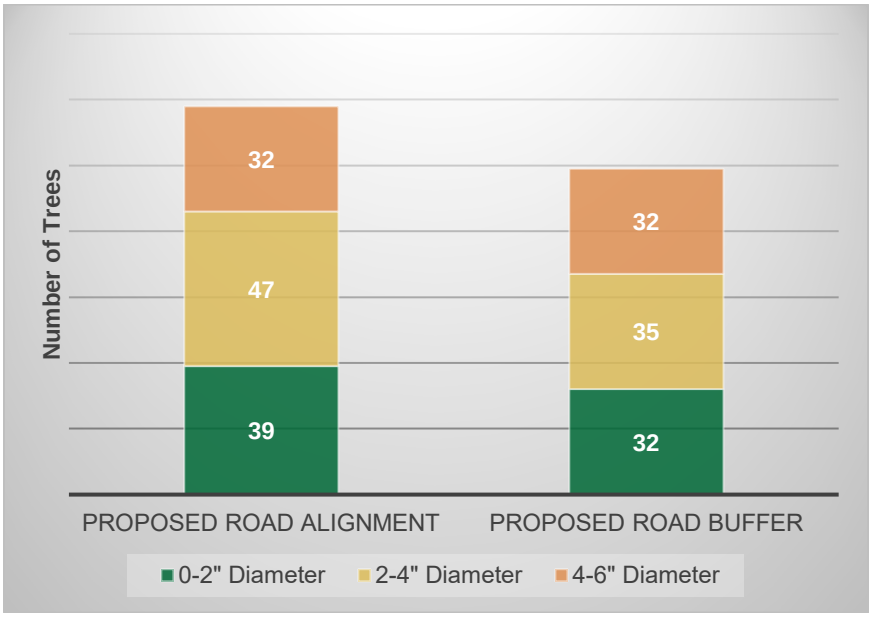
Species	Tree Id
big leaf maple	3339, 3145, 3368, 3381, 3447, 3126,
western hemlock	1675, UM3367, UM3061
western red cedar	3065

Smaller Tree Assessment

Small trees less than six inches in diameter were documented within the proposed road alignment and buffer. These trees are commonly overlooked during tree preservation work because they are often not required to be included in tree protection plans. Often these trees are better established and will grow faster than new plantings of the same size. The 217 trees documented consist mostly of western red cedar with a few (less than 10% combined) bigleaf maple, western hemlock, Sitka spruce, Pacific dogwood, and Douglas fir. Most of these small trees are in good health.

Trees range in height from 6 feet to 20 feet tall and are mostly located along or within easy access of the trail and adjacent flat areas. These young and small trees were likely planted for restoration purposes and may hold significance to park users and caretakers. Spatially, many of these trees are planted in clumps very close (less than 10 feet) together, and because most of the trees are thriving, the clumps are ready to be thinned to promote the growth and health of their neighbors. Slightly more of the small trees are located on the proposed road alignment (118) than in the buffer area (99) (Figure 3). The 118 trees within the road alignment will likely all require removal, however, it is possible that trees on the edge of the alignment and construction zone can be retained even if their roots will be damaged by construction.

Figure 3. Small Tree Distribution by Diameter Class



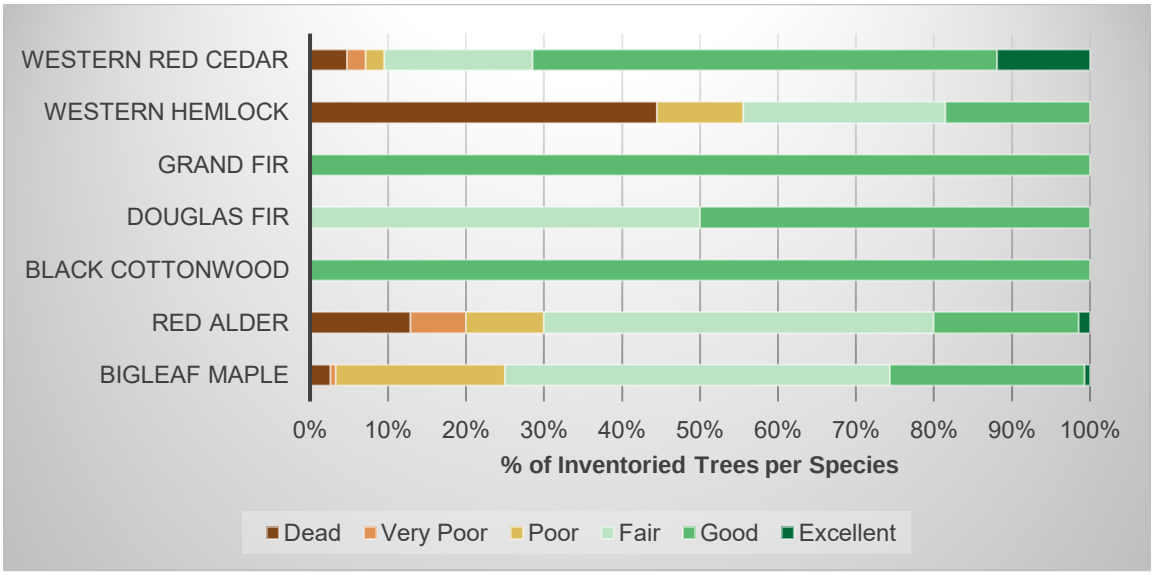
Tree Condition

Trees were assessed for structure, form and vigor using a combination of protocols developed by the International Society of Arboriculture and American Society of Consulting Arborists for Tree Risk Assessment and Landscape Appraisals (Appendix 4). Structure assessments focus on the stability of the tree and its ability to withstand construction impacts. Trees with new and uncorrected leans or with soil or root plate failures were considered to have poor structure. Short and stout trees often were considered to have better structure. Very few trees were rated with Excellent structure, and of these they were either small (<8 inches diameter) or exceptional in size. Many trees on moving slopes have roots growing up slope and a pistol butt formation on the downhill side. This structure is considered below average. A pistol butt formation will allow for closer construction impacts on the downhill sides of trees without causing harm if soils are stabilized, but they require greater caution to protect roots on the uphill side of trees. Tree structure is the most important factor in deciding if a tree or snag can be retained through construction disturbance without failing.

Tree form on this site is associated with the contribution and balance of the individual tree canopy with the surrounding forest canopy. Many maple trees are the same height and diameter, and the canopies are in the stage of natural thinning. Some tree canopies are very large and well balanced and others very small, asymmetrical or not very dense/thick. Corrected tree leans over 15% might be structurally stable but still have poor form. Trees with low live crown ratios or have partial crowns due to competition have poor form ratings. On this site, many alders and bigleaf maples hold lower form ratings and many of the larger and older trees have higher form ratings.

Lastly, tree health was assessed. On this site, health corelates closely with tree species (Figure 4). Most of the western hemlock on this site are in poor health and all will likely continue to decline in health in the next few years. Red alder, found mostly on the proposed road alignment, are not only smaller than those in the buffer (Figure 2), but they are also in the poorest health. Trees that have good structure and poor health were often recommended to be retained as snags.

Figure 4. Tree Health (Vigor) for trees > 6 inch



Snags and Habitat Trees

Trees identified as snags are all classified as dead, or very poor, or poor health (Figure 4). The 35 snags assessed consist mostly of western hemlock and red alder and range in size.

The larger conifer snags have good structure, but many are under stress, in decline, or have recently died. Almost all the western hemlocks in this inventory are classified as snags. These trees, both living, and dead contain cavities carved by woodpeckers and hollow trunks that are excellent for wildlife. Both signs and symptoms of multiple types of wood decay were identified including but not limited to *Ganoderma spp. Armillaria spp., and n*early all the large older maples have signs of *Kretzschmaria deusta.* These larger diameter maple trees are consistently shorter than the forest canopy and more stable than many of the taller maples with smaller diameters. The larger older trees in poor health with good structure will continue to provide excellent wildlife habitat if they can be retained.

Habitat snags with good structure were recommended for retention, or "*Retain with Treatment*" if the snag requires top removal, girdling, or branch reduction to minimize failures and negative impacts to construction personnel. Snags located within the proposed buffer with poor structure such as a lean over the trail that cannot be reasonably corrected are recommended for removal.

Table 2 identifies the snags located in the road alignment and within the buffer of the proposed temporary road. Tree numbers in yellow are recommended for height reduction and numbers in red are recommended for removal. About half the snags (16 of 29) located in the road buffer are structurally stable, have a high value, and are recommended to be protected. Snags recommended for removal or height reduction are either leaning or have structural instability and a high probability of impacting trail users or workers. Some snags can be managed through reduction of the height. Two snags on the edge of the road alignment (tree # 3061, 3367) are large and would provide habitat benefits even if left as a tall stump.

Table 2. Habitat Snag Numbers Within the Proposed Road Alignment and Buffer

Species	Within Proposed Road Buffer	Within Road Alignment
bigleaf maple	3211, 3265, 3396,3417,3492,	
red alder	1682, 1721, 1731, 3120, 3354, 3408, 3518 UMALRU	1716, 1715, 3190, 3327
western hemlock	1290, 1291, 3103, 3107, 3165, 3167, 3182, 3242, 3282, 3331, 3359	3061, 3367
western redcedar	3406, 3544 3136, UMTHPL, 3198	

**Tree ID in red are recommended for removal, Yellow are recommended for height reduction, Black can be retained with low risk to construction personnel.*

Analysis of Potential Construction Impacts

The tree data collected on site was cross referenced with the proposed temporary road plan. Recommendations were provided for each tree both within the proposed temporary road alignment and for those within the proposed buffer (Map 1). Trees were provided with one of 5 general recommendations associated with the proposed temporary road: *Retain* (*if possible*), *Retain with treatment, Remove for Risk, Remove non-viable, or Remove for construction*. Further detail can be found in the specifications and definitions section of this report.

Table 3 identifies the current distribution of trees within the proposed road alignment and within the buffer with general recommendations. Map 1 shows the recommendations for specific trees inside the proposed road alignment.

Map 2 shows the high and medium value trees recommended for retention within the proposed road buffer. Most of the trees located on the uphill side of the proposed road are either located above the eroding canyon slopes or they have roots growing up the slope. These trees can tolerate construction impacts very close to the trunks. Trees located on the slopes below the proposed road have extensive roots on their uphill side. Many of these trees are less than 10 feet away from the proposed road and would likely have roots impacted by construction.

In general, less structural damage will occur to trees if their roots are buried temporarily for construction than if they are permanently cut. In the areas where the slope is less steep, the road design calls for a fill slope that would bury tree roots. This allows for tree retention very close to the proposed road alignment. Where the side slope is steep however, the temporary road would likely be stabilized with a geotextile wall. The retaining wall design requires a six-foot flat surface cut into the hill below the road. Though most of this cut would be under the road alignment, two feet of this cut would impact native soil and tree roots on the down slope side of the wall. These cuts will impact roots of almost all the trees within the proposed road buffer below each wall.

Most of the trees within the buffer are recommended for retention, however many will require onsite assessment and decisions for retention should be made in the field when staking for the walls is completed. Impacted trees may still be retained except where significant root cutting will impact structural stability and create a hazard during construction.

In some areas along the proposed road, the height of the road will be over 10 feet above the base of retained trees. Tree pruning for clearance and trunk protection higher in the canopy may be required for trees retained on the slope below the proposed road alignment.

Recommendations for Trees Within the Proposed Road Alignment

These recommendations apply to trees within the construction area of both Option 1 and the shorter Option 3 alignment. Trees for option 3 can be referenced from the maps.

1. Promote bare root relocation of the smaller cedar trees 2 inches diameter or less. Trees can be moved to other areas of the park or to neighboring homes to improve urban forest canopy in the neighborhood. This will account for less than 50 of the 118 small trees.
    a. Remove the remaining larger (2-6 inches diameter) small trees and mitigate for these trees after construction.
    b. Diversify the tree species selected for the mitigation plantings.
    c. Mitigation trees should be planted in accordance with City of Seattle Standard Plan 030, Minimum Tree Clearances near existing sewer lines to minimize future tree removals for maintenance.
2. Identify the station locations for the 11 trees within the proposed temporary road alignment that were identified to have a higher preservation value (Table 3, Map 2 and 3). Assess the feasibility of road alignment changes, upper slope stabilization or other options for high value trees and their retention.

Table 3. Trees on the Proposed Road Alignment with a High Preservation Value

Species	Tree_ID	DBH	Vigor	Structure	Form
Western hemlock	1675	30.5	3	4	4
Bigleaf maple	1725	39.6	2	3	4
Bigleaf maple	3060	18.5	5	4	5
Western red cedar	3065	45.7	3	3	4
Bigleaf maple	3126	43.7	2	3	3
Bigleaf maple	3160	19	4	5	4
Bigleaf maple	3332	18.5	4	4	4
Bigleaf maple	3339	35.0	3	3	5
Bigleaf maple	3402	24.1	3	3	
Bigleaf maple	3447	35	3	4	4
Western hemlock	UM 3061	43.1	0	4	4

3. Remove and mitigate for the remaining 90 of 101 larger trees in the proposed temporary road.
   a. Four trees in the proposed road are recommended for removal due to risk regardless of construction (#'s 3221, 1716, 3258, 3063) these trees may fit into different mitigation requirements.
   b. Mitigate 55 trees to be removed that are over 12 inch diameter. These are mostly red alder and bigleaf maple.
   c. Only four of the trees to be removed are conifers. Cedar #3065, and hemlock #1675 are not extensively decayed and may be reusable on site for LWM if they cannot be retained.
4. Retain root balls in the soil for removed trees wherever possible for temporary soil stabilization below the temporary road.
5. In areas where the original soil grade will not be excavated, protect the soils and tree roots within the native soils under the road by installing a geo web fabric, or coir mats over the original soil grade. Add hog fuel, arborist wood chips, or other wood fiber for the temporary road before adding fill soil or crush rock. The wood fiber will decrease direct soil compaction by equipment on site and provide a compression barrier to minimize soil and root disturbance during road decommissioning. This soil protection is especially important within the Critical Root Zone (CRZ) of retained trees on the downslope side of the road.

Recommendations for the trees within the buffer areas.

1. Remove the 24 trees recommended for removal before construction (Table 4). Fifteen of these are in poor condition and will likely fail in the next few years and require clean up for construction. All these trees will be a safety concern for workers in the area based on the Level 1 Risk Assessment conducted.
   a. Alternatively, a Level 2 Basic Risk Assessment may be conducted for further documentation. Target focus was on construction workers and their equipment in work areas. Other targets include parking along Holyoke, trail benches where people congregate and failing trees easily accessed by trail users.
   b. Recommended trees will decrease in number for Option 3. The Arc GIS database should be used to identify Level 1 documented high-risk trees.

Table 4. Trees Within the Road Buffer Recommended for Construction Risk Removal

Species	Tree_ID	DBH	Vigor	Structure	Notes
western hemlock	1290	21.1	0	2	Snag with *Ganoderma* on the trunk Lean with large canopy over the trail
bigleaf maple	1699	14.9	3	3	Tree roots hold up slope. This tree protects western red cedar.
red alder	1719	12.6	2	1	Tree has over 15-degree uncorrected leans to south over trail.
red alder	1721	8	1	2	Decayed snag with trunk overhanging bridge
red alder	3020	20.1	3	1	Tree has failed and is hung up in another tree over the trail.
western red cedar	3059	12	4	2	Tree is being undercut do not excavate near base without removal of this tree first.
bigleaf maple	3076	14	3	3	Closest of the five maple trees lean and tree proximity to the top of the bank will damage the trail
red alder	3087	21.9	1	2	many broken branches
western hemlock	3115	12.6	3	1	Off balance form on decaying trunk. Puffball fungus (bark beetles/ sapwood decay) on trunk. Remove two trunks
bigleaf maple	3206	10.5	2	2	Pistol butt tree paired with 3207
red alder	3239	21.8	4	2	Tree has a significant lean over the trail . Old wounds and visible decay in trunk (very old) Tree lean is corrected at the top. Trunk has split at 30 feet with old broken branches.
bigleaf maple	3265	6.5	0	1	Snag
red alder	3313	21.5	3	1	Soil cracks on west and south side indicate soil failure Tree is over the trail, with its recent history will likely fail under wet windy conditions
bigleaf maple	3396	24	0	2	Snag
red alder	3408	26	0	1	Snag with lean
red alder	3486	19.5	2	2	Lean to stream. Photo tropic leans Old seam on downhill side, with crown containing multiple dead branches
bigleaf maple	3487	24	2	2	Foliage in the crown is thin and this tree is showing signs of decline with moss and bark loss of the multiple top
red alder	3520	16.3	3	1	Soil root plate failure with an over 15 deg lean
bigleaf maple	UM ACMA	14	4	1	South side of tree row near tree #3059 with bank undercut. No soil under root plate/root and trunk structure.
bigleaf maple	UM ACMA	14	3	2	Symmetrical canopy near tree 3059 Bank is eroding and tree roots and stem overhang bank by 6 feet
bigleaf maple	UM ACMA	26	4	2	Single stem with lean. Tree will require removal if any excavation occurs on the bank
red alder	UM ALRU	16	0	2	Snag
red alder	UM ALRU	18	0	2	Snag
red alder	UM ALRU	18	2	1	Significant lean over the stream, with vertical seams and broken branches indicating this tree is still moving

2. At a minimum, design the tree protection area (TPA) for high value trees using the Interior Critical Root Zone (ICRZ) calculations (See Appendix 4). Tree drip lines are uneven for this site and do not represent the root system requirements for trees on this site.
    a. All retained trees should have their ICRZ identified on the construction plans.
    b. Adjust the geotextile walls to be as far away from trees as possible and at least outside the ICRZ of retained trees down slope.
    c. Many trees on the up-slope side of the road can be impacted closer than the ICRZ. No retained trees should have impacts to more than one side of the tree.

3. Provide a closer inspection and prioritize the retention of the 33 high value trees located near the road (Table 5, Map 2 and 3). These trees either have extremely large root systems extending into the proposed road area or extend only uphill, or they are just a few feet from the proposed road edge.

Table 5. High Preservation Value Trees in the Road Buffer that are Likely to be Impacted by Construction.

Species	Tree_ID	DBH
bigleaf maple	1033	28.1
bigleaf maple	1710	20
bigleaf maple	1727	29
Western red cedar	3121	43.5
Western red cedar	3159	28
Western red cedar	3162	29.6
Western red cedar	3198	50.6
bigleaf maple	3211	33.3
Douglas fir	3228	41.3
Western red cedar	3284	43
bigleaf maple	3291	23.7
bigleaf maple	3308	29.3
black cottonwood	3326	36
Western red cedar	3356	58
black cottonwood	3383	30
Western hemlock	3407	24
Western red cedar	3427	12
Western red cedar	UM 1124	46.4
Western red cedar	*UM 1300*	*43.6*
Western hemlock	UM 1421	36.9
bigleaf maple	*UM 1473*	*23.9*
Western red cedar	UM 1698	38
bigleaf maple	UM 3035	50
Douglas fir	UM 3127	59.8
Western hemlock	UM 3182	28.1
Douglas fir	UM 3218	53.9
Western hemlock	UM 3349	50
Western red cedar	UM 3363	44
Western red cedar	UM 3544	28
Douglas fir	UM PSME	30
Douglas fir	UM PSME	30
Western red cedar	UM THPL	40
Western red cedar	UM THPL	40

4. Where geotextile walls cannot be moved to retain these trees, alternative wall designs that minimize excavation in the root zone are recommended.

5. After plans are finalized and Tree removal and protection decisions are complete, ensure tree protection and a TVSPP are incorporated into the engineering plans. The following recommendations are specific to this forested site and can be incorporated into the TVSPP in addition to other standard requirements.
    a. Add temporary erosion control such as straw waddles and jute netting and two to four inches of hog fuel, arborist wood chips or coarse mulch to any open bare ground around trees within and surrounding the road buffer. This is to protect trees from construction as well as to reduce soil erosion. Mulch can be obtained from trees removed for construction.
    b. Prune all retained trees for construction clearance. Pruning should be conducted by ISA certified arborists. Pruning for all retained trees should be minimal and focused on clearance and safety goals.
    c. Protect the trunks of all trees next to the road and near the stream access areas by using plywood boards, fencing, wrap, or other hard surface to reduce accidental heavy equipment or woody debris impacts to living tree bark.
    d. Retain an arborist during construction surveying to assist with field adaptations, data collection updates and inspection of tree protection before construction.
    e. Whenever excavation is to occur within the TPA, an arborist should be on site to monitor root impacts, root prune and provide guidance to minimize tree root damage.

Conclusions

The trees assessed in Dead Horse Canyon tell the story of a forest in transition. Old conifers including recently deceased hemlock snags and large bigleaf maples, are sparsely scattered through a younger deciduous forest. These larger older trees provide habitat value and diversity that will take a century to develop with the younger smaller trees. In the meantime, the younger overstory canopy of bigleaf maple competes for light and are in the process of self-thinning and the middle-aged red alders are nearly all in decline associated with competition for light. Though these are natural forest processes, the actively moving slopes on this site may significantly contribute to the tree losses in this forest. Human disturbance to this forest such as urban heat island effects to storm water runoff frequency and intensity to historic utility installation, invasive species proliferation, and subsequent invasive vegetation removal, without intensive temporary erosion control; all significantly contribute to the current condition of the trees in this forest. With or without construction of a road, this forest will require a significant input of resources over the next few decades to stabilize slopes and develop a diverse understory canopy that can adapt to many different and potentially unknown stresses in the future.

This report primarily describes the assessment and recommendations for the full-length temporary road associated with Option 1. The assessment can be applied to those trees within the roadway alignment and buffer for Option 3 as well. The proposed road is in a good location to minimize direct removals of large exceptional trees, small adaptations to the road alignment may decrease this further.

Within the buffer of the road alignment many trees on the upslope side of the rode can be retained very close to construction without damaging root systems, however trees on the down slope side of construction require greater root protection. Without adaptations to location or

design of the roadway retention wall, all the surveyed trees located on the downhill side within 10 feet of the walls will have structural root impacts that may cause failures or significant health decline during and after construction. Large trees over 20-inch diameter will be impacted if within 15 feet. While adaptations in design may be possible, many individual tree impacts will require field assessment after grading surveys are installed and while excavation is being conducted.

There is no question that many trees in the buffer that are recommended to be retained in this assessment will have some root damaged during construction. These trees should be retained as part of this forested environment to avoid unnecessary removals and impacts addressed after construction for mitigation purposes. After the trees identified in this report as having high preservation value trees are reviewed and assessed against the construction plans, tree protection plans should be finalized and incorporated into the civil plan set. No matter what option is selected some tree removal and some tree impacts will likely be required to repair and mitigate the stream, slope and forest transition occurring in the Dead horse canyon. Focusing removal to smaller less healthy trees and retaining older, larger and healthier trees is one step toward minimizing those impacts.

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Appendix I: Summary Tables for Trees Within the Temporary Roadway Alignment and Buffer for Options 1 and 3

Option 1- Full Road ~2,700 feet	Diameter (inches)	Trees in Roadway Alignment for full road				Trees in Buffer for Full road				Total in Alignment and Buffer
Large Tree Survey		Deciduous	Conifer	**Total**	**Notes on Removal**	Deciduous	Conifer	**Total**	**Notes on Removal**	
Trees (> 6") Seattle Tree Code 25.11	6-12"	29	14	**43**	**Remove**	35	12	**47**	**Retain if Possible**	**90**
	12-18"	24	0	**24**	**Remove**	42	8	**50**	**Retain if Possible**	**74**
	18-24"	16	0	**16**	**Remove**	35	3	**38**	**Retain if Possible**	**54**
	24-30"	6	0	**6**	**Remove**	18	9	**27**	**Retain if Possible**	**33**
Exceptional Trees (>30")	>30"	7	4	**11**	**Assess**	14	29	**43**	**Retain- Assess Trees on downhill side**	**54**
Subtotal		**82**	**18**	**100**		**144**	**61**	**205**		**305**
Small Tree Survey										
Trees < 6"	0-2"	2	37	**39**	**Remove**	1	31	**32**	**Retain if Possible**	**71**
	2-4"	7	40	**47**	**Remove**	12	23	**35**	**Retain if Possible**	**82**
	4-6"	7	25	**32**	**Remove**	11	21	**32**	**Retain if Possible**	**64**
Subtotal		**16**	**102**	**118**		**24**	**75**	**99**		**217**
Total				**218**				**304**		**522**

Option 3 - Partial Road ~1,250 feet	Diameter (Inches)	Trees in Roadway Alignment for partial road				Trees in Buffer for partial road				Total in Alignment and Buffer
Large Tree Survey		Deciduous	Conifer	**Total**	**Notes on Removal**	Deciduous	Conifer	**Total**	**Notes on Removal, Impact, Likely Survival**	
Trees (> 6")	6-12"	14	5	**19**	**Remove**	11	4	**15**	**Retain if Possible**	34
Seattle Tree	12-18"	14	0	**14**	**Remove**	17	5	**22**	**Retain if Possible**	36
Code 25.11	18-24"	5	0	**5**	**Remove**	17	1	**18**	**Retain if Possible**	23
	24-30"	4	0	**4**	**Remove**	9	3	**12**	**Retain if Possible**	16
Exceptional Trees (>30")	>30"	3	2	**5**	**Assess**	7	14	**21**	**Retain- Assess on downhill side**	26
Subtotal				**47**				**88**		**135**
Small Tree Survey										
Trees (< 6")	0-2"	2	18	**20**	**Remove**	0	10	**10**	**Retain if Possible**	30
	2-4"	2	15	**17**	**Remove**	0	11	**11**	**Retain if Possible**	28
	4-6"	4	6	**10**	**Remove**	3	1	**4**	**Retain if Possible**	14
Subtotal				**47**				**25**		**72**
Total				**94**				**113**		**207**

Appendix II: Inventory Photos

Unique and High Preservation value trees

Photo 1-3: The large, bigleaf maples and cedar tree 3065 are located on the downhill side of the trail. These trees have significant root systems that support the slope and are recommended for retention if possible. Trees with this form also provide the sense of a mature forest.

Photo 4. Maple tree 3040 has 10 stems. One stem (tree 3046) is closest to the trail. If management is needed for construction remove the tops of the stems but do not remove root systems.

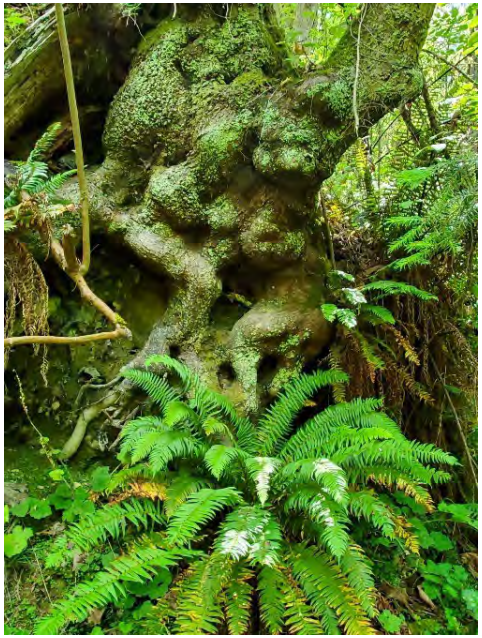


Photo 5. Tree 3527 has a unique root system and is holding up the bank.

Photo 6. This hemlock is above the trail and has unusual form. Snag only if management is needed.

Soil Erosion examples

Photo 7-9. Examples where soil erosion above the trail is undercutting the bank and destabilizing trees. The untagged maple (UM ACMA) is undercut (arrow) beneath the trunk and is hanging in midair attached to the slope by a few roots.

Trees with low retention value



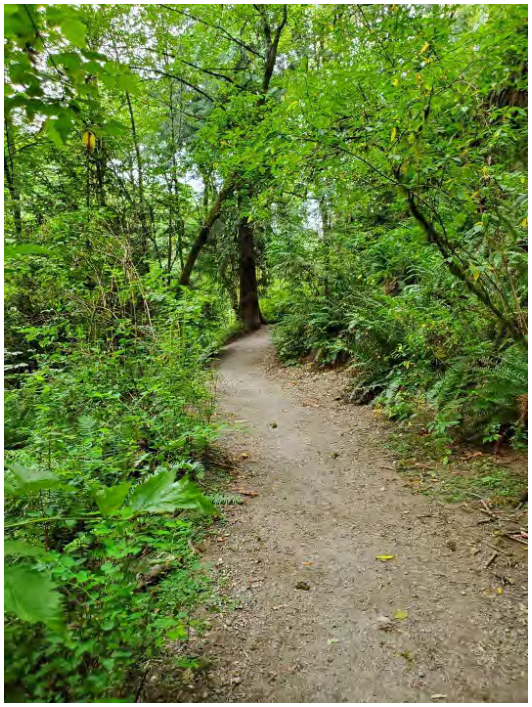


Photo 10-12: Tall and skinny trees with leans over the trail, or with root plate failures that will impact the trail were recommended for removal even if they were not located in the proposed roadbed.

Habitat Trees

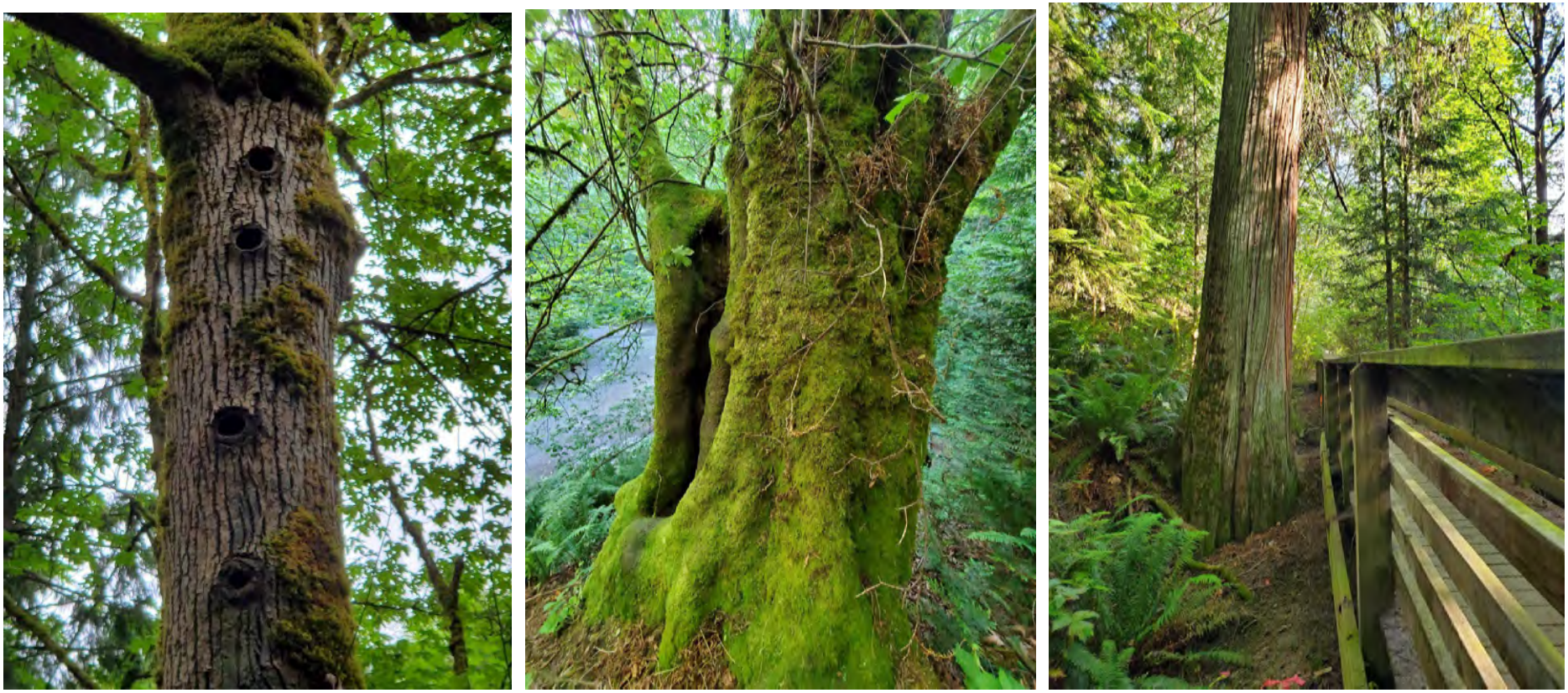


Photo 13-15. Habitat trees can be living or dead snags. Some have hollow cavities or unique branching patterns. Many large western hemlock, bigleaf maple and western redcedars have high habitat value.

Individual and contributing Tree Canopies

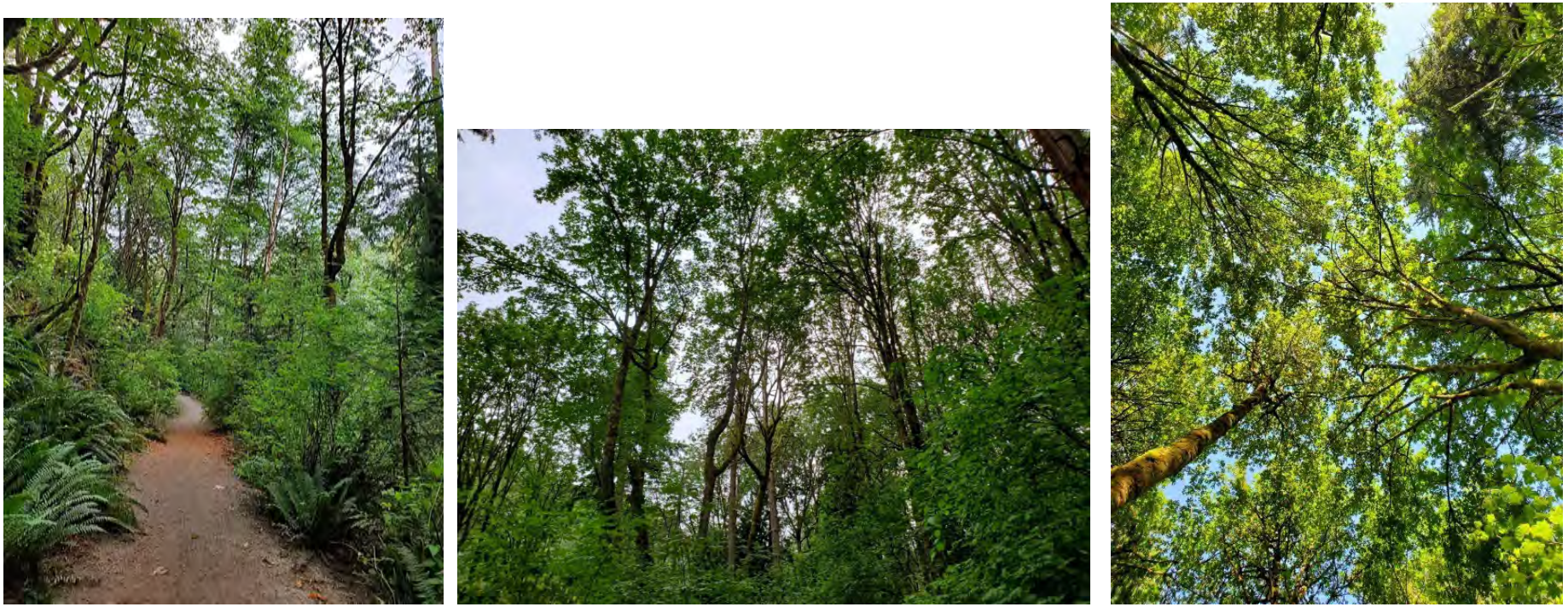


Photo 16-18: The forest canopy through the project area is deciduous, dominated by bigleaf maple and primarily one thin canopy layer 80 to 100 feet tall. The canopy during summer has many openings and light gaps and in the winter after leaf fall is very open. Tree canopies are small in width and very uneven relative to single open grown trees.

Appendix III: Tree Inventory Maps

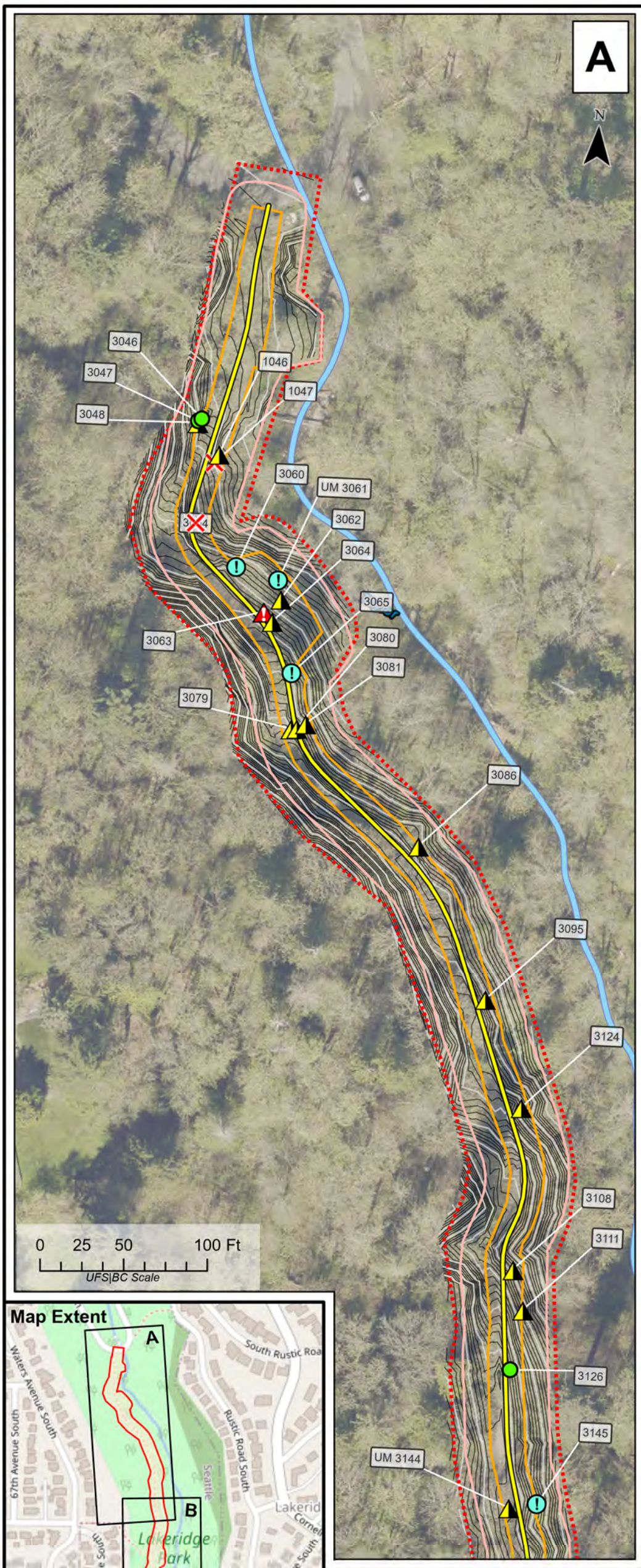
Management Recommendations - Trees over 6" diameter within the Proposed Road Alignment"

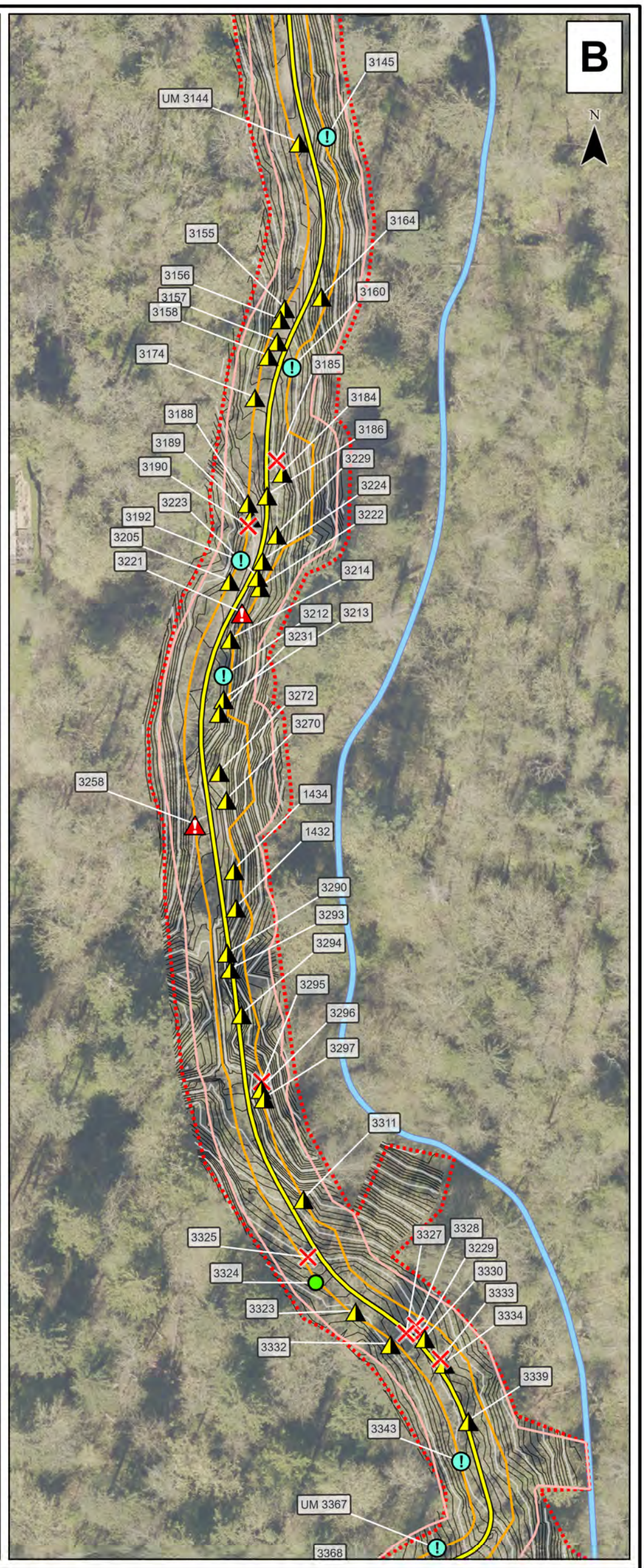
SPU Taylor Creek Improvements Project

Management Recommendations - Trees within the Proposed Project Area

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company
15119 McLean Road
Mount Vernon, WA. 98273
1(360)-399-1377
urbanforestryservices.com





Symbols: (Approximate locations)

Labeling

1234	Existing Tree ID number
ACMA	Tree species code. See report for code key.
UM	Unmapped - not included in the provided survey dataset. placement is approximate not survey quality
NS	non-significant. less that 6" DBH

Recommendations

- Retain
- Retain with treatment(s)
- Remove non-viable
- Remove for construction
- Remove for risk

Boundaries/features

- Proposed Project Area
- Taylor Creek
- Trail Alignment
- Indirect Impact Zone
- Direct Impact Area

Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

TA-A1

SPU Taylor Creek Improvements Project

Management Recommendations - Trees within the Proposed Project Area

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Division of The F.A. Bartlett Tree Expert Company
15119 McLean Road
Mount Vernon, WA. 98273
1(360)-399-1377
urbanforestryservices.com

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UM 3491
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3502
UM ACMA
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3420
3428
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3019

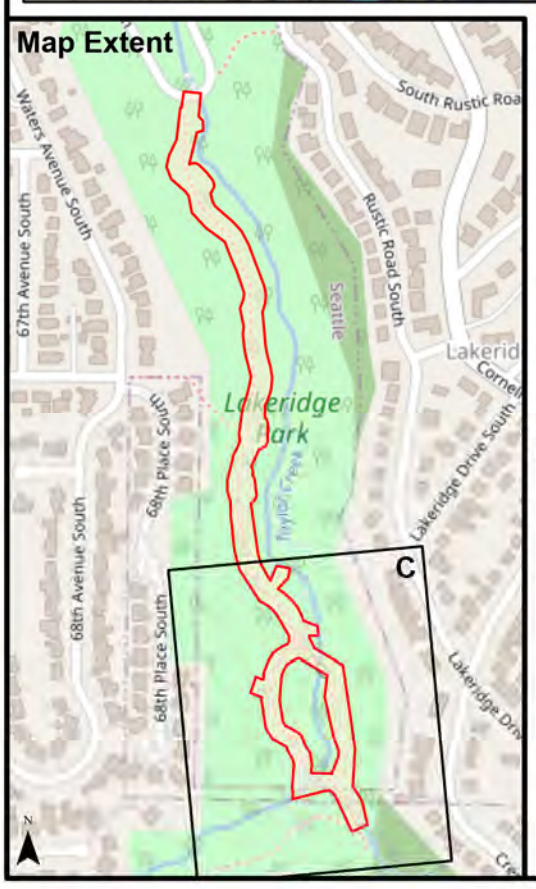
Seattle

Taylor - W Fork

Taylor - E Fork

0 25 50 100 Ft
UFS|BC Scale
N

Map Extent



Symbols: (Approximate locations)

Labeling

1234	Existing Tree ID number
ACMA	Tree species code. See report for code key.
UM	Unmapped - not included in the provided survey dataset. placement is approximate not survey quality
NS	non-significant. less that 6" DBH

Recommendations

- Retain
- Retain with treatment(s)
- Remove non-viable
- Remove for construction
- Remove for risk

Boundaries/features

- Proposed Project Area
- Taylor Creek
- Trail Alignment
- Indirect Impact Zone
- Direct Impact Area

Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

Trees Recommend for Retention

SPU Taylor Creek Improvements Project
Trees Recommended for Retention Assessment

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company
15119 McLean Road
Mount Vernon, WA. 98273
1(360)-399-1377
urbanforestryservices.com

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UM 3035, 1033, 1034, UM ACMA, 1036, UM ACMA, UM ACMA, 3046, 3047, 3041, 3048, 1037, 1035, 1046, 1047, 3049, UM ACMA, 3054, 3060, UM 3061, 3062, 3063, 3064, UM TSHE, 3065, 3067, Taylor, 3066, UM 3057, 3059, UM ACMA, 3081, UM ACMA, 3079, 3080, 3082, 3088, 3087, 3086, UM ACMA, UM 1124, 3076, 3094, 3095, 3121, 3115, 3124, 3120, 3113, UM 3100, 3108, UM ACMA, 3111, 3107, 3126, UM 3127, UM 3132, UM 3128, 3136, 3145, UM 3144

0 25 50 100 Ft
UFS|BC Scale

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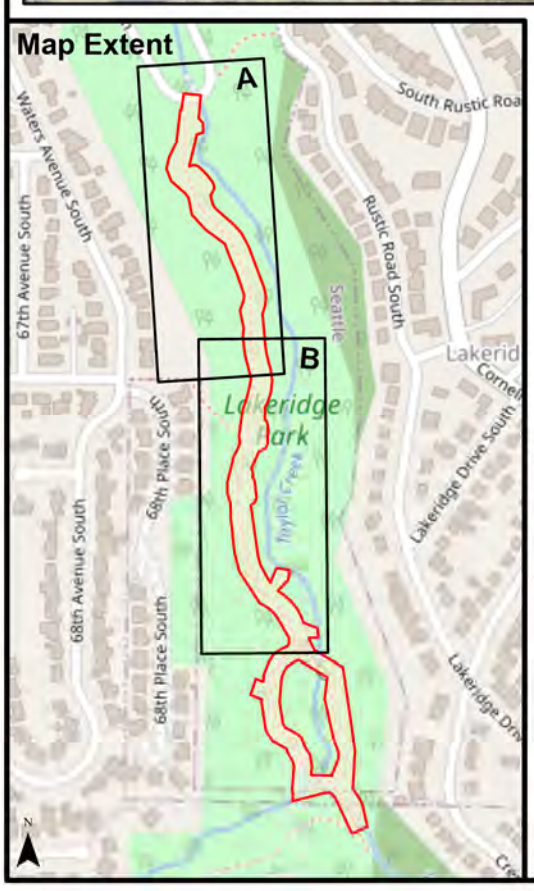
Map Extent



Symbols: (Approximate locations)

Labeling

- **1234** Existing Tree ID number
- **ACMA** Tree species code. See report for code key.
- **UM** Unmapped - not included in the provided survey dataset. placement is approximate not survey quality
- **NS** non-significant. less that 6" DBH

Preservation Value*

- High
- Medium
- Low

Boundaries/features

- Proposed Project Area
- Taylor Creek
- Trail Alignment
- Indirect Impact Zone
- Direct Impact Area

Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

TA-B1

SPU Taylor Creek Improvements Project
Trees Recommended for Retention Assessment

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company
15119 McLean Road
Mount Vernon, WA. 98273
1(360)-399-1377
urbanforestryservices.com

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W Fork

Taylor Creek

Seattle

Taylor - E Fork

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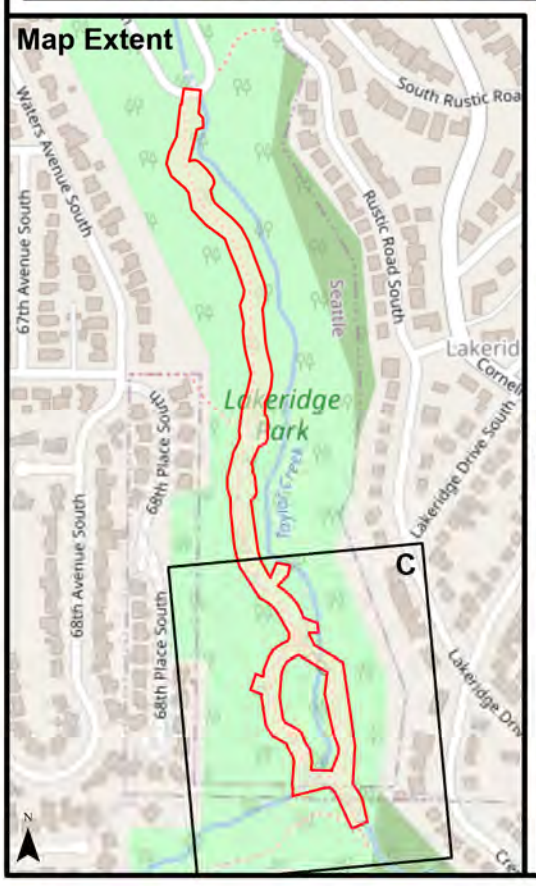

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Preservation Value*

- High
- Medium
- Low

Boundaries/features

- Proposed Project Area
- Taylor Creek
- Trail Alignment
- Indirect Impact Zone
- Direct Impact Area

Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

TA-B2

Preservation Value of Trees Over 30” Diameter

SPU Taylor Creek Improvements Project
Preservation Value of Large Trees*

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company
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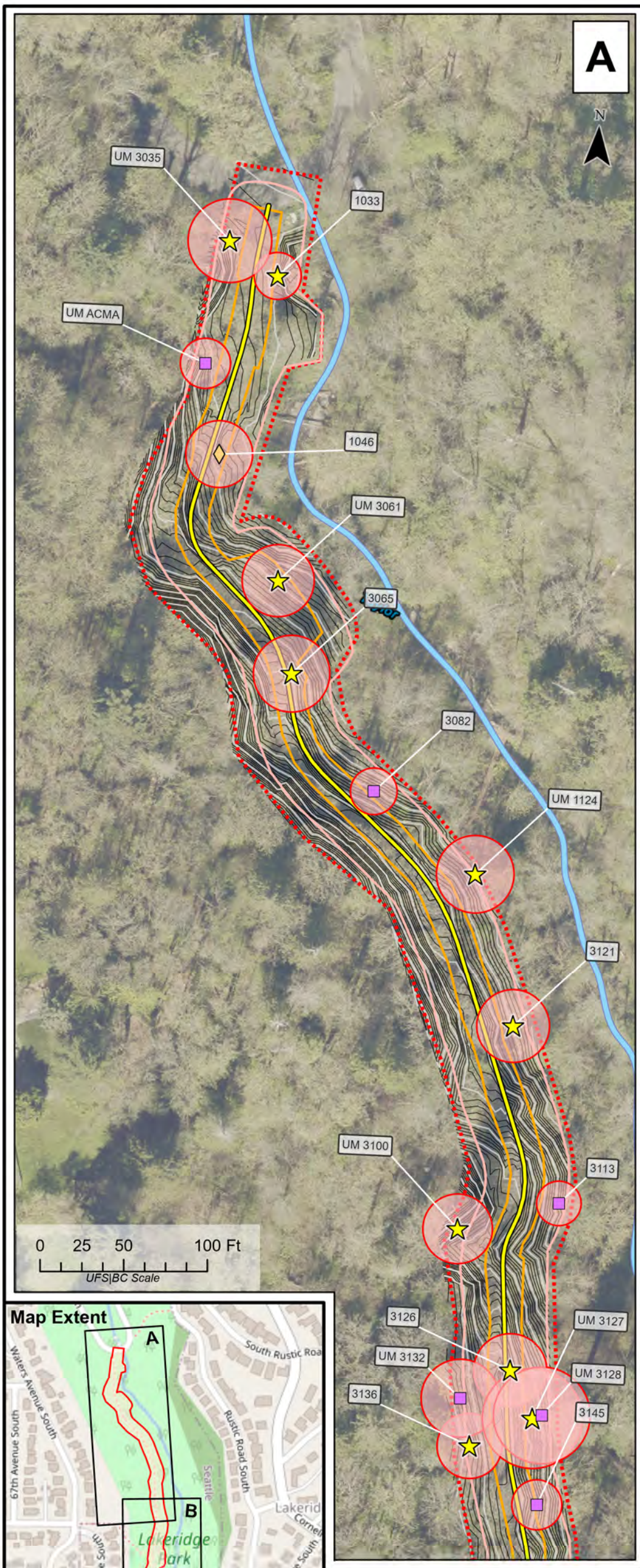

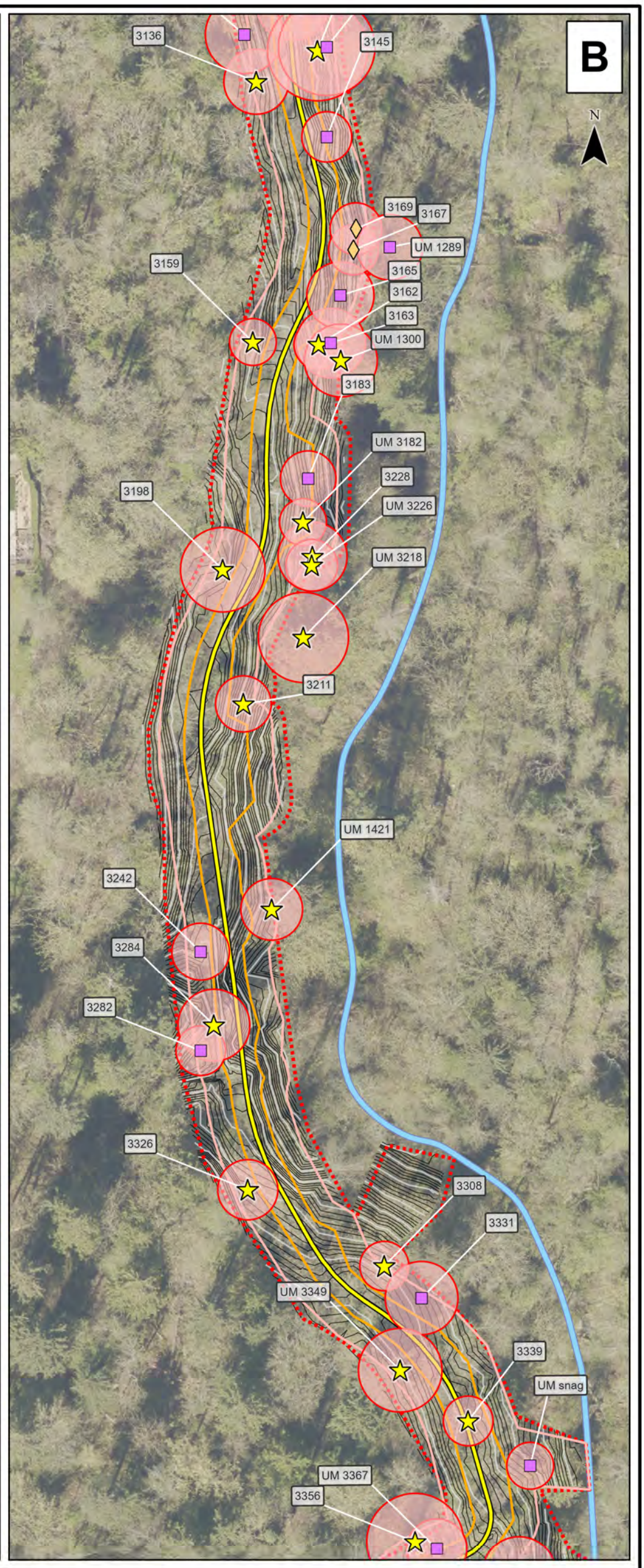

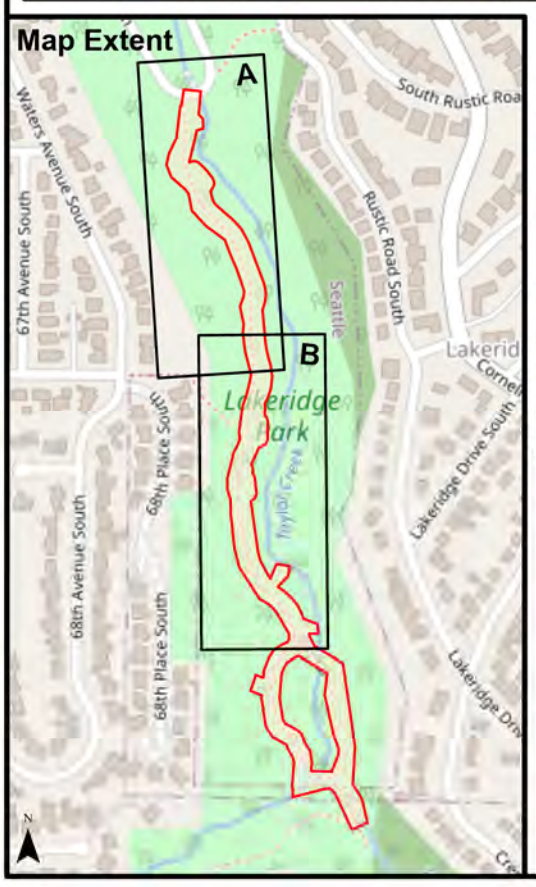

Symbols: (Approximate locations)

Labeling

1234	Existing Tree ID number
ACMA	Tree species code. See report for code key.
UM	Unmapped - not included in the provided survey dataset. placement is approximate not survey quality
NS	non-significant. less that 6" DBH

Preservation Value*

- High
- Medium
- Low

Boundaries/features

- Proposed Project Area
- Taylor Creek
- Trail Alignment
- Indirect Impact Zone
- Direct Impact Area

Interior Critical Root Zone (ICRZ). See the attached CRZ Explanation document for details

**Large Trees = trees greater than 30" DBH*

Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

TA-C1

SPU Taylor Creek Improvements Project
Preservation Value of Large Trees*

Lakeridge Park - 10201 Holyoke Way South
Seattle, Washington 98178

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company
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Taylor - W Fork
Taylor - E Fork
Seattle

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UFS|BC Scale
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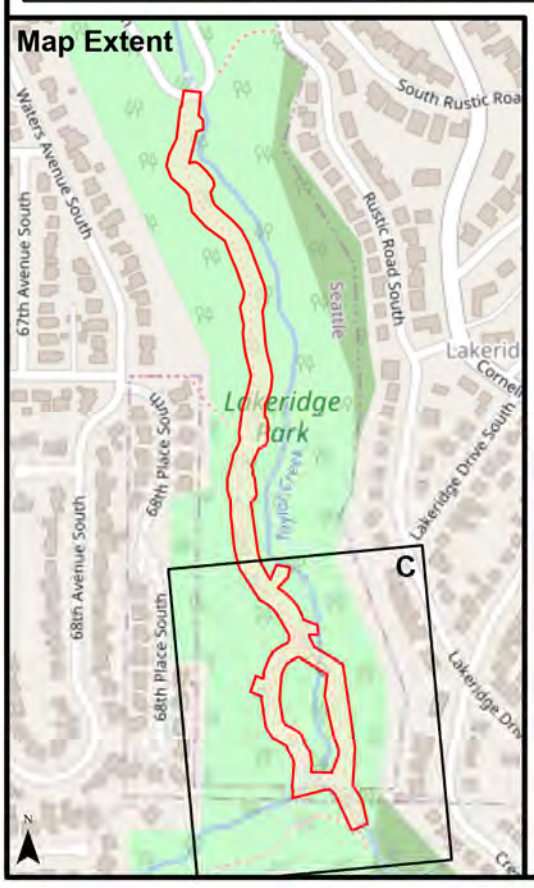
Map Extent



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Project alignment and buffer layers provided by SPU, 2022. Aerial imagery retrieved from King County GIS Portal, 2021

TA-C2

Appendix 4: Details for Specifications and Definitions

Condition Components Table

Rating Category	Rating Number	Health	Structure	Form
Excellent	5	High vigor and nearly perfect health with little or no twig dieback, discoloration or defoliation.	Nearly ideal and free of defects.	Nearly ideal for the species. Generally symmetric. Consistent with the intended use.
Good	4	Vigor is normal for the species. No significant damage due to diseases or pests. Any twig dieback, defoliation or discoloration is minor.	Well-developed structure. Defects are minor and can be corrected.	Minor asymmetries / deviations from species norm. Mostly consistent with the intended use. Function and aesthetics are not compromised.
Fair	3	Reduced vigor. Damage due to insects or diseases may be significant and associated with defoliation but is not likely to be fatal. Twig dieback, defoliation, discoloration and/or dead branches may comprise up to 50% of the crown.	A single defect of a significant nature or multiple moderate defects. Defects are not practical to correct or would require multiple treatment over several years.	Major asymmetries/deviations from species norm and/or intended use. Function, vigor and/or aesthetics are compromised. Codominant canopy in forest environment
Poor	2	Unhealthy and declining in appearance. Poor vigor. Low foliage density and poor foliage color are present. Potentially fatal pest infestation. Extensive twig and/or branch dieback.	A single serious defect or multiple significant defects. Recent change in tree orientation. Observed structural problems cannot be corrected.	Largely asymmetric/abnormal. Detracts from intended use and/or aesthetics to a significant degree. Canopy too small to support growth and maintenance. Intermediate canopy in a forest environment.
Very poor	1	Poor vigor. Appears to be dying and in the last stages of life. Little live foliage.	Single or multiple severe defects and failures.	Visually unappealing. Provides little or no function in the landscape. Suppressed canopy in a forest environment. Visually unappealing snag with habitat features
Dead	0	No living foliage for over a year. No live cambium.	Tree actively failing or breaking apart.	Poorly created snag with no habitat features

Adapted from Table 4.1. "Assessment of plant condition". Guide for Plant appraisal 10th Edition, second printing. 2019. Council of tree and Landscape Appraisers, Published by the International Society of Arboriculture.

Tree Risk Assessment Level Descriptions

The tree risk assessment process is based on factors present at the time of assessment. Because trees are living, growing things that change in size and condition over time, the tree assessment process must also recognize and anticipate where and when future assessments should be performed. The Tree Risk Assessment Qualification (TRAQ) training and methodology, developed and administered by the International Society of Arboriculture is the best available methodology for tree risk assessment at this time. There are three levels of assessment that may be considered and employed according to the expectations of the owner or manager, conditions of the site and of the trees involved:

Level 1 Limited Visual Assessment: Includes a broad overview of an individual tree or group of trees near specified targets, conducted to identify obvious defects or other conditions of concern. A limited visual assessment typically focuses on identifying trees with imminent and/or probable likelihood of failure. Level 1 assessments do not always meet the criteria for a "risk assessment" if they do not include documented analysis and evaluation of individual trees. This level is typically used for large populations of trees as a means to quickly identify trees with imminent and/or probable likelihood of failure, at a specified schedule and/or immediately after storms.

Level 1 assessments may be done as walk-by, drive-by or aerial patrols as requested by the tree owner or manager. They may not provide enough information to develop risk mitigation recommendations. They can help identify specific areas and/or trees for further inspection at Level 2 or 3. Trees found to require a Level 2 Basic Assessment are assessed, mapped and documented at the higher level at this time. Trees determined to need a Level 3 Advanced Tree Assessment are documented and recommended for additional testing and analysis. The owner is notified with options discussed.

Level 2 Basic Assessment: This is a detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around the tree, looking at the site, buttress roots, trunk, and branches. This basic assessment may include the use of simple tools to gain additional information about the tree or defects. Our Level 2 Basic Assessment Trees are all typically tagged, mapped and information gathered and retained for each tree. Risk mitigation recommendations may be derived from this level of inspection. Defects found in a Level 2 Basic Tree Assessment may require a Level 3 assessment for further testing and analysis. The owner is notified with options discussed.

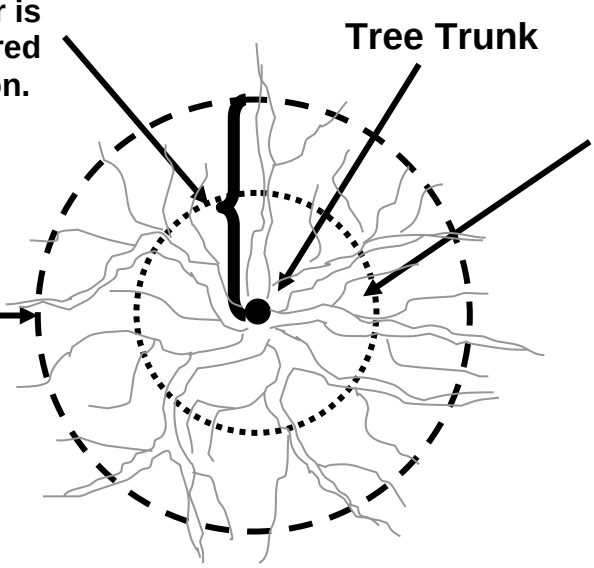
Level 3 Advanced Assessment: Advanced assessments are performed to provide more highly detailed information about specific tree components, defects, targets or site conditions. An advanced assessment is performed in conjunction with or after a Level 2 Basic Assessment if the assessor determines the need for (requires) additional information. This level is particularly useful where there are concerns about trees that may otherwise be of high value, or to obtain better information on how serious or extensive a particular defect is. The Level 3 Advanced Tree assessment may include but not be limited to a root crown inspection with air spade, Resistograph or Tomograph use to determine sound wood or an aerial crown inspection.

The preliminary Level 1 Limited Visual Assessment if requested would help determine where field assessments at Level 2 and Level 3 will be needed.

Critical Root Zone (CRZ) =
12" Radius for every Tree inch diameter is generally considered optimum protection.

Perimeter Critical Root Zone (PCRZ)
= the outer half of the CRZ

The greater the disturbance allowed in this area, the greater Post Care is required.



Interior Critical Root Zone (ICRZ)
= the inner half of the CRZ
Protecting only this area would cause significant impact to the tree, potentially life threatening, and would require maximum Post Care Treatment to retain the tree. See Post Care Treatment below.

The Critical Root Zone (CRZ) of a tree is established on the basis of the trunk diameter. The CRZ is a circular area which has a radius of 12 inches for every inch diameter of trunk measured at 4.5 feet above grade. Root systems will vary both in depth and spread depending on size of tree, soils, water table, species and other factors. However, this CRZ description is generally accepted in the tree industry. Protecting this entire root zone area should result in no adverse impact to the tree, except for potentially increased exposure.

The above CRZ drawing has been further differentiated into the Perimeter (PCRZ) and Interior (ICRZ) to help define potential impact and required post care.

Generally, limiting disturbance to outside of the full CRZ is considered the optimum amount of root protection for a tree. Encroaching into the Perimeter CRZ requires greater post care for the tree to remain healthy and stable.

The Interior CRZ (ICRZ) is half the radius of the Perimeter CRZ (PCRZ) and approximately equal to the size of a root ball needed to transplant the tree. Disturbance within any part of the Interior CRZ could destabilize or cause the tree to decline and should be avoided if the tree is to be retained. Due to the immense variability between individual trees and root systems, partial encroachment into the Interior CRZ can be considered on a case by case basis under direction by a certified arborist or similarly qualified tree professional.

This post care treatment would include but may not be limited to; regular irrigation, misting, root treatment with special root hormones or growth stimulants, mulching, guying and monitoring for several years. Lack of this treatment could be fatal.

Urban Forestry Services
BARTLETT CONSULTING
Divisions of The F.A. Bartlett Tree Expert Company

15119 McLean Road
Mount Vernon, Washington 98273
360-428-5810

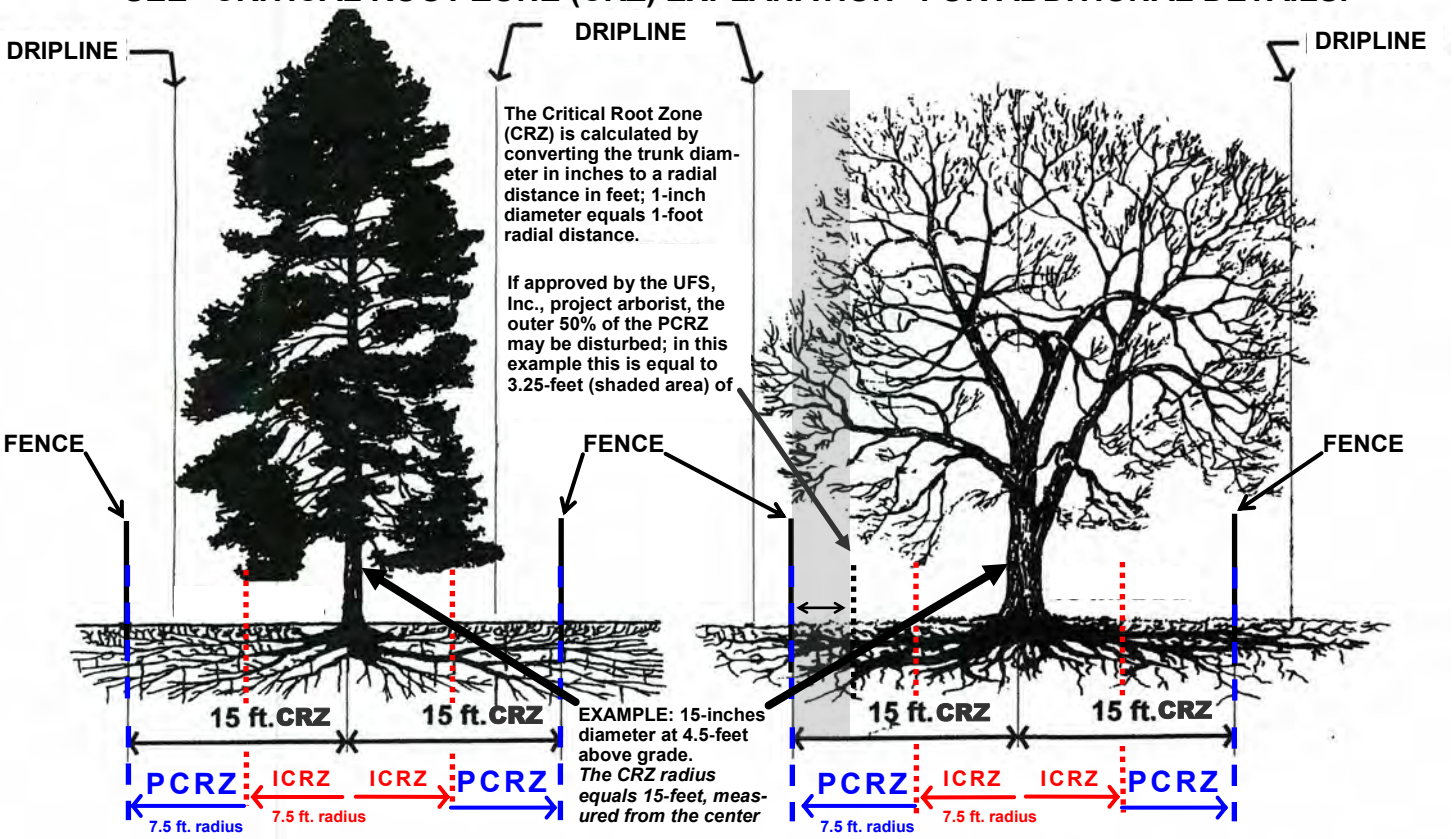
Title: Critical Root Zone (CRZ) Explanation
Source: Urban Forestry Services, Inc
Jim Barborinas, ISA Certified Arborist PN-0135
ASCA Registered Consulting Arborist #356,
Tree Risk Assessor Qualified

Date: 2020 **Not to Scale**

TREE PROTECTION AREA— PROTECTION FENCE

NOT TO SCALE

SEE "CRITICAL ROOT ZONE (CRZ) EXPLANATION" FOR ADDITIONAL DETAILS.



Steel posts anchored into the ground and 4-foot orange chain link fence. Fence is not to be moved without authorization by the arborist.
No parking, storage, dumping within the tree protection fence.

Any work within the tree protection fence is to be reviewed and monitored by the arborist. Use low impact techniques to

Apply 18-inches of woodchips or other ground protection measures within the protection area. See "General Tree Protection Guidelines" for additional details (Item no.9 "Soil protection".)

Orange fencing commonly fails and will require weekly inspection and maintenance to maintain proper function.

SEE "GENERAL TREE PROTECTION GUIDELINES" FOR ADDITIONAL DETAILS.

BARTLETT Urban Forestry Services BARTLETT CONSULTING Divisions of The F.A. Bartlett Tree Expert Company	**ORANGE PROTECTION FENCE DETAIL**	
	Sheet 1 **2020**	**NOT TO SCALE**

WILDLIFE SNAG DETAIL

Snag Selection

In some locations, trees slated for removal may be converted to a wildlife snag. A snag can be created from a dead or live tree. In general, the best candidates will be at least 15-inches diameter and not affected by root disease or decay. Work should be completed by an ISA certified Arborist® trained and experienced in wildlife tree creation. Trees cut to mimic the character of naturally occurring snags offer the best functions and appearance in the landscape.

Functional Wildlife Snags

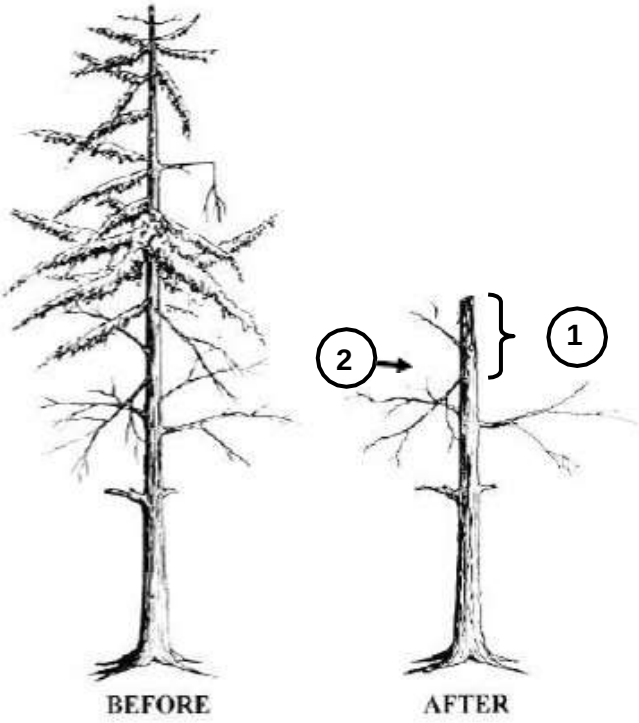
Topping, heading, and jagged cuts are harmful to healthy trees but are appropriate when creating functional wildlife snags. The height of the snag or a retained standing dead tree should not exceed the distance to a valuable target. Multiple snags near each other should be cut to different heights.

(1) On live trees, the snag should be clear of live branches for at least the top 5-feet. This reduces the likelihood of lateral branches growing upward and potentially becoming a future hazard.

(2) Retain live or dead branch stubs near the top to serve as perches. **Natural fracture pruning** uses ropes (or a combination of partial cuts and ropes) to pull branches downward to break them.

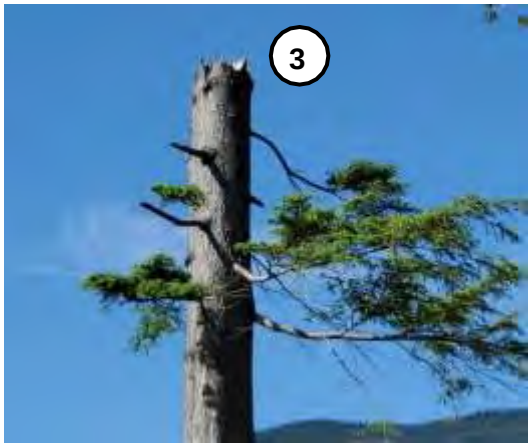
(3) **Coronet cuts** create a jagged surface at the cut end to mimic a natural break at the top of a snag.

(4) Retain and/or create cavities to allow for cavity nesting opportunities.



Signage

"Wildlife Tree" signs attached to snags that are visible to the public will help explain why the snag is there and to distinguish it from inappropriately topped trees.



Monitoring

Living snags near high value targets require additional attention to ensure they aren't producing dangerous new shoot growth. Annual monitoring and ISA Tree Risk Assessments are recommended for this type of snag.

Resources

ISA Certified Arborists® trained and skilled in creating wildlife trees can provide more specialized habitat features.

https://dnrtreelink.wordpress.com/2016/12/09/how-to-make-a-wildlife-tree/

https://backyardhabitats.org/wp-content/uploads/2017/07/Snags-Living-with-urban-wildlife.pdf

GENERAL TREE PROTECTION GUIDELINES

With Critical Root Zone Explanation Attachment

1. **Responsibilities**: These guidelines apply to work provided by all contractors and subcontractors on the project. These Guidelines pertain to any disturbance, use, or activity within the Critical Root Zone of any retained tree on this project. See the attached **Critical Root Zone Explanation** for reference.

   The owner's arborist, general contractor, and municipal representative shall meet on site before any site work begins to review and designate the most appropriate methods to be used to protect the retained trees during construction.

   The project consulting arborist shall be contacted prior to any work that may need to enter the tree protection fencing. Three (3) working days' notice shall be provided to the project consulting arborist. A proposed method for work near any retained trees shall be provided to the arborist. This method shall be reviewed by the project consulting arborist and either approval and/or comments provided by the project consulting arborist prior to commencing works within the tree protection area. The project consulting arborist should be notified within 8 hours should any injury occur to any protected tree or its larger roots (greater than 2-inch diameter) so that appropriate assessment and/or treatment may be made.

2. **Soil Disturbance:** No soil disturbance shall take place before required soil treatments, mulch, and tree protection barriers are installed. All assessed trees to be retained within these areas shall be clearly illustrated in the final Site Plan(s).

3. **Designated Tree Removals:** The owner's arborist and contractor shall confirm on-site which trees are to be removed and those to be retained. Directional felling and removal of trees must be completed with great care to avoid any damage to the trunks, branches, and critical root zones of the retained trees.

4. **The Tree Assessment and Protection Site Plans and Clearing and Grading Plans** show the recommended location of the Tree Protection Fence (TPF). Immediately after the clearing limits and grading stakes are set in the field, the owner's arborist, during review and discussion with the contractor, will make a final determination on the tree protection requirements depending on construction limits and impact on major roots and soil condition. The arborist may adjust clearing limits in the field so that, in their opinion, tree roots and soils are protected while necessary work can proceed.

5. **The Tree Protection Fence** (TPF) shall be installed in the locations shown on the Tree Assessment and Protection Site Plan, with special consideration of the Critical Root Zone (CRZ) of trees to be preserved. The CRZ of a tree is generally described as an area equal to a 1-foot radius for every 1-inch diameter of tree trunk (measured at 4.5-feet from grade

(DBH)). For example, a 10-inch diameter tree has a CRZ of a 10-foot radius. Work within the CRZ may be limited to hand work or alternate methods of construction.

The Tree Protection Fence (TPF) shall be constructed with steel posts driven into the ground with 6-ft. chain link cyclone fence attached. Upon consultation with the contractor, the project consulting arborist shall determine the final placement of the fence and the extent and method of clearing that may be done near preserved trees. Additional follow-up determinations may be required as work progresses on the project. See attached **Critical Root Zone Explanation**.

No parking, storage, dumping, or burning of materials is allowed beyond the clearing limits or within the Tree Protection Fence.

The TPF shall not be moved without authorization by the owner's consulting arborist or municipal representative/arborist. The TPF shall remain in place for the duration of the project.

Tree protection signs shall be posted on all outer-facing sides of the fencing at 15-foot intervals. (See guideline 10 below for signage guidance)

Work within the tree protection fence area shall be reviewed with and approved by the owner's arborist. Call Urban Forestry Services | Bartlett Consulting at 360-399-1377 with questions.

6. **Trunk Protection:** In some restricted or tight areas of the site, standard TPF may not be feasible or effective. Construct plywood trunk protection around the retained trees where construction is near the Interior Critical Root Zone (ICRZ). Construct the trunk protection out of four (4), 4-foot x 8-foot sheets of plywood, on end, fastened at the corners, forming a box around the trunk.

   Tree protection signs shall be posted on all sides of the plywood box structure. (See guideline 10 below for signage guidance)

7. **Branch Protection:** Install branch protection where the likelihood of heavy equipment damaging lateral branches of retained trees is high. Branch protection shall consist of a closed-cell foam padding material wrapped around the exposed lateral branches above or within the vicinity of construction activity.

   Pruning may be allowed if approved by an ISA Certified Arborist® in advance. Alternatively, branches may be tied back out of the way of construction work.

8. **Silt Fence:** If a silt fence is required to be installed within the Critical Root Zone of a retained tree, the bottom of the silt fence shall not be buried in a trench but instead folded over and placed flat on the ground. The flat portion of the silt fence shall be covered with gravel or soil for anchorage.

9. **CRZ over Hardscape:** Where the Critical Root Zone (CRZ) includes an area covered by hardscape, the TPF can be placed along the edge of the hardscape if and until it is removed. After hardscape removal, the available CRZ should be backfilled with topsoil up to 6 inches deep and incorporated into the soil (if no roots will be damaged in the process) and protected with the TPF. Incorporation of topsoil into the existing sub-grade shall be

determined by the consulting arborist. Where applicable, a specification for topsoil can be provided or approved by UFS|BC.

10. **Tree Protection Signs** shall be attached to the outside of tree protection fencing and plywood trunk protection at 15-foot intervals and on all sides/aspects. Signage shall be shown as required on the Site Plan. The signage should read "**TREE PROTECTION FENCE. DO NOT ENTER THIS AREA. DO NOT PARK OR STORE MATERIAL WITHIN THE PROTECTION AREA.**" Monetary Fines based on the appraised dollar value of the retained trees may also be included on these signs. Telephone contact details for the project consulting arborist should also be included on the signs.

    A bilingual UFS|BC branded sign is attached for ease of availability and production. This sign can be readily printed on weather-resistant sign material and fastened to the tree protection fencing or plywood trunk protection panels. Custom versions of this sign can be provided upon request to include alternative messaging, QR codes linking to specific project information/plans, etc.

11. **Soil Protection within the Critical Root Zone (CRZ):** four (4) inches of wood chip mulch shall be placed over all exposed and protected soil within the CRZ of a retained and protected tree (not including hardscape surfaces). A biodegradable coir mat netting is recommended to be placed on the existing grade before woodchip placement to protect the condition and confirm the location of the existing grade. The netting is a valuable benchmark that defines the original grade upon removal of the material within the CRZ. If left it will degrade over time.

    Where vehicular access is required, a temporary work pad or storage pad is required within the CRZ of any preserved tree that is not protected with hardscape; the soil shall be protected with 12 inches of woodchips and ¾-inch plywood or 1-inch metal sheets to protect from soil compaction and damage to roots of retained trees.

12. **Landscape Plans, Irrigation Design, and Installation Details:** Great care shall be exercised when landscaping within the CRZ of any tree. Roots of preserved trees and other vegetation shall not be damaged by planting or installation of irrigation lines. The owner's consulting arborist shall review the Landscape Plan for any potential design and tree preservation conflicts and approve related irrigation and landscape installation activities within the CRZ of retained trees. A proposed method for work shall be provided to and approved by the consulting arborist.

13. **Backfill and Grade Changes:** The owner's arborist will determine to what extent backfilling may be allowed within the Critical Root Zone of a preserved tree and, if needed, the specific material which may be used. Grade cuts are usually more detrimental than grade filling within the CRZ and should be reviewed by the arborist well in advance of construction.

14. **Tree Maintenance and Pruning:** Trees recommended for maintenance and approved by the owner shall be pruned for deadwood, low hanging branches, and proper balance, as recommended for safety, clearance, or aesthetics. An International Society of Arboriculture Certified Arborist® shall complete all pruning. *ANSI A300 American Standards for Pruning* shall be used.

    Branches of retained trees within 10 feet or less of any power line, depending on power line voltage, may only be pruned by a Utility Certified Arborist. This pruning must be coordinated with the local power company, as they may prefer to provide this pruning.

Of specific concern are branches over any construction access points. Obstructing branches shall be properly pruned or tied back before damage can occur.

15. **Underground Utilities:** Utility installation within the Critical Root Zone (CRZ) of any retained tree shall be reviewed by the project consulting arborist. A less root disturbing route or minimal impact installation method of utility installation may be discussed and recommended (i.e., tunneling or trenchless excavation). Trenching through the Interior CRZ of a retained tree is not usually allowed. **See CRZ Explanation to differentiate between the Perimeter and Interior CRZ**. An Air Spade or Air Knife and Vacuum Truck may be required when utility installation is mandatory near a retained tree or other methodology such as trenchless excavation. The method of utility installation shall be determined on a case-by-case basis after a review of the depth, width, and location of the proposed impact.

16. **Root Pruning:** Required work may result in the cutting of roots of retained trees. Cutting roots 2 inches or greater must be avoided. Potential root pruning needs should be reviewed in advance with the project consulting arborist to minimize potential root fracturing and other damage. Severed roots of retained trees shall be cut off cleanly with a sharp saw or pruning shears. Applying pruning paint on trunk or root wounds is not recommended. Severed roots shall be covered immediately after final pruning with moist soil or covered with mulch until covered with soil. Excavation equipment operators shall take extreme care not to hook roots and pull them back towards retained trees. In all cases, the excavator shall sit outside of the CRZ. Soil excavation within the CRZ shall be under the direct supervision of the owner's consulting arborist.

17. **Supplemental Tree Irrigation:** If clearing is performed during the summer, supplemental watering and/or mulch over the root systems within the Tree Protection Fencing of preserved trees may be required by the owner's consulting arborist. The consulting arborist should be notified of the proposed schedule for clearing and grading work. Supplemental watering and mulching over the root systems of roots impacted or stressed trees are strongly recommended to compensate for root loss and initiate new root growth.

    Long periods of slow drip irrigation will be most effective, though watering bags may be an effective method for some street trees. A large coil of soaker hose starting at least 18 inches from the trunk and covering the Interior Critical Root Zone area is recommended. Water once per week and check soils for at least 12 inches of infiltration. This work shall be under the direct supervision of the owner's consulting arborist.

18. **Additional Measures:** Additional tree protection recommendations may be required and may be specified in UFS|BC report(s) or follow-up memos. In addition, the pertinent regulatory city/municipal/county may require additional tree, plant, and soil protection measures not specified here that will need to be implemented.

19. **Final Inspection:** The owner's consulting arborist shall make a final site visit to report on retained tree condition following completed work and shall report to the city.