

# Arboricultural Inventory and Report

For:  
Polygon Homes

Site Location:  
The Conservatory – UBC Lot 5  
(at Berton Avenue and Binning Road)

To be submitted with Tree Management Plan  
dated November 18, 2019.

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Submitted to:  
Polygon Homes  
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Date: November 18, 2019

Submitted by:



The following Diamond Head Consulting staff conducted the on-site tree inventory and prepared or reviewed the report.

All general and professional liability insurance and staff accreditations are provided below for reference.

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Please contact us if there are any questions or concerns about the contents of this report.

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**Scope of Assignment:**

Diamond Head Consulting Ltd. (DHC) was retained to complete an arboricultural assessment to supplement the proposed development application for Lot 5 at Binning Road and Berton Avenue, UBC, Vancouver. This report contains an inventory of protected on and off-site trees and summarizes management recommendations with respect to future development plans and construction activities. Off-site trees are included because pursuant to municipal bylaws, site owners must include the management of off-site trees that are within the scope of the development. This report is produced with the following primary limitations, detailed limitations specified in Appendix 7:

- 1) Our investigation is based solely on visual inspection of the trees during our last site visit. This inspection is conducted from ground level. We do not conduct aerial inspections, soil tests or below grade root examinations to assess the condition of tree root systems unless specifically contracted to do so.
- 2) Unless otherwise stated, tree risk assessments in this report are limited to trees with a *high* or *extreme* risk rating in their current condition, and in context of their surrounding land use at the time of assessment.
- 3) The scope of work is primarily determined by site boundaries and local tree-related bylaws. Only trees specified in the scope of work were assessed.
- 4) Beyond six months from the date of this report, the client must contact DHC to confirm its validity because site base plans and tree conditions may change beyond the original report's scope. Additional site visits and report revisions may be required after this point to ensure report accuracy for the municipality's development permit application process. Site visits and reporting required after the first submission are not included within the original proposal fee and will be charged to the client at an additional cost.

**The client is responsible for:**

- Reviewing this report to understand and implement all tree **risk**, removal and protection requirements related to the project.
- Understanding that we did not assess trees off the subject property and therefore cannot be held liable for actions you or your contractors may undertake in developing this property which may affect the trees on neighboring properties.
- Obtaining a tree removal permit from the relevant municipal authority prior to any tree cutting.
- Obtaining relevant permission from adjacent property owners before removing off-site trees and vegetation.
- Obtaining a timber mark if logs are being transported offsite.
- Ensuring the project is compliant with the tree permit conditions.
- Constructing and maintaining tree protection fencing.
- Ensuring an arborist is present onsite to supervise any works in or near tree protection zones.

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## 1.0 Introduction

### 1.1 Site Overview

The subject site has an area of 0.46 ha. An area in the north west corner comprising approximately  $\frac{1}{8}$  of the site has been cleared. The remaining area is occupied by a mature second-growth conifer-dominated stand with several notable large trees (Photos 1 and 2). The stand has recently experienced a substantial amount of windthrow failure (e.g. Photo 3), exposing a new stand edge on the west side. New condo towers are present on lots to the south and west.

### 1.2 Proposed Land Use Changes

It is our understanding that the proposed consists of a mixed-use development. In preparing this report, we reviewed the following information:

1. Base Survey, Site Plan and Parkade Plan provided by dys architecture.

### 1.3 Report Objective

This report has been prepared to ensure the proposed development is compliant with UBC Technical Guidelines Section 32 01 93.01 for Tree and Shrub Preservation in relation to development. Protected trees identified on the subject site and documented in this report have a diameter at breast height of 15 cm or greater.

This report outlines the existing condition of trees adjacent to the subject site that have a drip line or critical root zone that extends on to the subject site, summarizes the proposed off-site tree retention and removal, and suggests guidelines for protecting retained trees during the construction process.

## 2.0 Process and Methods

Ian MacLachlan of DHC visited the site on September 5<sup>th</sup>, 2019. The following methods and standards are used throughout this report.

### 2.1 Tree Inventory

Trees on site and trees shared with adjacent properties were marked with a numbered tag and assessed for attributes including: species; height measured to the nearest meter; and, diameter at breast height (DBH) measured to the nearest centimeter at 1.4 m above grade. Off-site trees were inventoried, but not tagged. The general health and structural integrity of each tree was assessed visually and assigned to one of five categories: *excellent*; *good*; *moderate*; *poor*; or *dying/dead*. Descriptions of the health and structure rating criteria are given in Appendix 3.

Tree retention value, categorized as *high*, *medium*, *low*, or *nil*, was assigned to each tree or group of trees based on their health and structure rating, and potential longevity in a developed environment. Descriptions of the retention value ratings are given in Appendix 4. Recommendations for tree retention or removal were determined by taking in to account a tree's retention value rating, its location in relation to proposed building envelopes and development infrastructure.

### 2.2 Tree Risk Assessment

Tree risk assessments were completed following methods of the ISA Tree Risk Assessment Manual<sup>1</sup> published in 2013 by the International Society of Arboriculture, which is the current industry standard for assessing tree risk. This methodology assigns risk based on the likelihood of failure, the likelihood of impact and the severity of consequence if a failure occurs. Only on-site hazard trees that had *high* or *extreme* risk ratings in their current condition and in context of their surrounding land use were identified and reported in section 3.2. Appendix 5 gives the likelihood and risk rating matrices used to categorize tree risk. DHC recommends that on-site trees be re-assessed for risk after the site conditions change (e.g. after damaging weather events, site disturbance from construction, creation of new targets during construction or in the final developed landscape).

### 2.3 Tree Protection and Replacement

Tree Protection Zones were calculated to be the six-times the diameter of each tree, but may be modified based on professional judgement of the project arborist to accommodate species specific tolerances and site specific growing conditions.

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<sup>1</sup> Dunster, J.A., Smiley, E.T., Matheny, N. and Lilly, S. (2013). Tree Risk Assessment Manual. *International Society of Arboriculture*. Champaign, Illinois.

## 3.0 Findings: Tree Inventory and Risk Assessment

### 3.1 Tree Inventory

The tree inventory is summarized in Table 1 and the complete tree inventory is given in Appendix 1.

The on-site stand had been significantly impacted by windthrow failure of large trees. This had created a newly exposed edge on the west side and many of the exposed trees had poor trunk taper in this context. Several large dominant trees that had good trunk taper and crown development in context of their exposed situation remained at or outside the new stand edge (Photo 4).

Sixty (60) living on-site trees were identified. Fourteen (14) trees had a *good* health and structure rating, 30 were *moderate* and 16 were *poor*. Two additional trees were dead and not included in our summary counts (Table 1). Two exceptionally large Douglas-firs, numbers 3288 and 3330 were identified. They have good structural characteristics for long-term retention and *high* retention value.

Six (6) UBC boulevard katsura trees were present in the boulevard of Binning Avenue, immediately adjacent to the subject site. These trees all had *good* health and structure ratings and *moderate* retention value.

DHC definitions for health and structure, and retention value ratings are given in Appendices 3 and 4 respectively.

### 3.2 Tree Risk Assessment

There were no trees on this site that posed a *high* or *extreme* risk to targets that were present at the time of assessment. One notably tall dead hemlock tree, number 3302 (Photo 1), appears to have died in the last two to three years and had evidence of recent woodpecker activity in the upper third of the main stem. Tree 3322 is also a dead hemlock that could impact parking bays on the west side of Binning Road. These trees are not currently assessed to be a high-risk but have the potential to impact off-site targets and we advise their removal within the next year, regardless of on-site development plans or progress.

Table 1: Summary live trees of the tree inventory from BCR Lot 5 at Binning Road and Berton Avenue, containing the number of trees categorized by retention value and the recommended number to be retained or removed. The complete tree inventory is given in Appendix 1.

Tree Species	Retention Value				Recommendation		
	Nil	Low	Medium	High	Remove	Retain	Total
<b>On-Site Trees</b>							
Big-Leaf Maple		1			1	0	1
Black Cottonwood		1			1	0	1
Silver Birch			1		1	0	1
Water Birch			1		1	0	1
Douglas-Fir		2	5	8	15	0	15
Western Hemlock	1	5			6	0	6
Western Red Cedar		26	8	1	35	0	35
<b>On-Site Total</b>	<b>1</b>	<b>35</b>	<b>15</b>	<b>9</b>	<b>60</b>	<b>0</b>	<b>60</b>
<b>UBC Boulevard Trees</b>							
Katsura			6		0	6	6
<b>Grand Total</b>	<b>1</b>	<b>35</b>	<b>21</b>	<b>9</b>	<b>60</b>	<b>6</b>	<b>66</b>

## 4.0 Discussion and Summary

The subject site is a remnant native forest stand that has been exposed by surrounding developments to the south and west. Recent windthrow failure of large trees in the stand was extensive and exposed a new stand edge. Most remaining trees in the stand had *poor* or *moderate* health and structure ratings, and *low* or *moderate* retention value in context of their exposed situation. Several large Douglas-firs (numbers 3276, 3288, 3292, 3321, 3330 and 3331) that were dominant and emergent in the original stand have *good* health and structure ratings with *high* retention value. All trees on-site conflict with excavation required for the proposed underground parkade. Two dead hemlock trees, numbers 3302 and 3322, are proposed for removal within the next 12 months. Neither tree is assessed to be high-risk at the current time, but they could potentially to impact high-value targets in the future.

Six healthy katsura trees are planted in the adjacent boulevard of Binning Road. These trees do not conflict with the proposed works shown on the plans provided and can be protected and retained. Any works to occur within the tree protection zones of these trees must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation. It is worth noting that the six trees are of a suitable size and condition that transplanting would be a feasible way to mitigate future conflicts with street and sidewalk upgrades to Binning Road.

The location of all on-site and off-site trees is located on the accompanying DHC Tree Management Plan, dated November 18, 2019.



## Appendix 1 Complete Tree Inventory Table

The complete tree inventory below contains information on tree attributes and recommendations for removal or retention. Tree ownership in this inventory table is not definitive, its determination here is based on information available from the legal site survey, GPS locations, and field assessment during site visits. Tree Protection Zones are measured from the outer edge of a tree’s stem. If using these measurements for mapping the tree protection zone, ½ the tree’s diameter must be added to the distance to accommodate a survey point at the tree’s center. Where tree protection fencing is proposed to vary from the minimum municipal TPZ, comments will be included in the Retention/TPZ comments and shown on the Tree Management Plan.

\*TPZ is the tree protection zone size required by the relevant municipal bylaw or, if not defined, the project arborist.

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
236	On-Site	Western Hemlock	Tsuga heterophylla	16	9	80-100%	3	Moderate	Un-surveyed. Natural regeneration. Minor basal sweep. Healthy foliage.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
237	On-Site	Western Hemlock	Tsuga heterophylla	21	11	80-100%	3	Moderate	Survey tag 6680. Natural regeneration. Moderate basal sweep. Healthy foliage.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
238	On-Site	Water Birch	Betula occidentalis	23	10	80-100%	4	Good	Survey tag 6681. Dominant tree in naturally regenerating clump. Good form. Healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	2.0
239	On-Site	Silver Birch	Betula pendula	19	10	80-100%	4	Good	Survey tag 6694. Dominant tree in naturally regenerating clump. Good form. Healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
240	On-Site	Western Hemlock	Tsuga heterophylla	21	11	80-100%	4	Moderate	Survey tag 6606. Natural regeneration. 90-degree basal sweep. Healthy foliage.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
241	On-Site	Western Hemlock	Tsuga heterophylla	26	6	60-79%	3	Poor	Survey tag 6688. On nurse stump, top smashed.	Nil	Remove	Conflicts with excavation for proposed underground parkade. Also unsuitable for retention due to pre-existing conditions.	2.0
242	On-Site	Western Hemlock	Tsuga heterophylla	22	8	60-79%	3	Moderate	Has survey tag 6691 but not on survey plan. Previously suppressed, now exposed. Conical crown. Healthy.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
243	On-Site	Western Hemlock	Tsuga heterophylla	26	8	60-79%	3	Moderate	Survey tag 6692. Previously suppressed, now exposed. Conical crown. Healthy.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
244	On-Site	Western Red Cedar	Thuja plicata	28	10	60-79%	3	Good	Landscape planting 1.0 m off-site. Conical form, healthy foliage.	High	Remove	Conflicts with excavation for proposed underground parkade.	2.0
3274	On-Site	Western Red Cedar	Thuja plicata	81	31	60-79%	5	Moderate	Corner tree. Moderate taper. Codominant stems from 22 m, union unclear. Crown entirely asymmetrical to south east. Good foliage density.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.9

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3275	On-Site	Western Red Cedar	Thuja plicata	102	42	60-79%	5	Poor	Edge tree. Has basal flare, possible decay column behind occluded wound. Three codominant stems in crown from poor unions. Crown asymmetrical to south. Moderate foliage density.	Low	Remove	Conflicts with excavation for proposed underground parkade.	6.1
3276	On-Site	Douglas-Fir	Pseudotsuga menziesii	112	54	40-59%	9	Good	Edge tree with good taper and conical form. Healthy foliage.	High	Remove	Conflicts with excavation for proposed underground parkade.	6.7
3277	On-Site	Western Red Cedar	Thuja plicata	36	22	40-59%	3	Poor	Suppressed.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.2
3278	On-Site	Western Red Cedar	Thuja plicata	24	17	60-79%	3	Poor	Suppressed. Poor taper. Thin crown.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
3279	On-Site	Western Red Cedar	Thuja plicata	38	20	60-79%	4	Poor	Poor taper. Crown entirely asymmetrical to south. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.3
3280	On-Site	Western Red Cedar	Thuja plicata	34	23	60-79%	5	Poor	Recently exposed to west. Moderate taper. Narrow crown asymmetrical to south. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3281	On-Site	Western Red Cedar	Thuja plicata	81	40	60-79%	5	Poor	In stand. Survey is in wrong place relative to 3282. Partial recent exposure. Moderate taper. Narrow crown asymmetrical to east. Foliage density poor.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.9
3282	On-Site	Western Red Cedar	Thuja plicata	108	40	60-79%	5	Poor	Recently exposed to west. Moderate taper. Narrow crown asymmetrical to east. Foliage moderately healthy.	Low	Remove	Conflicts with excavation for proposed underground parkade.	6.5
3288	On-Site	Douglas-Fir	Pseudotsuga menziesii	128	54	40-59%	9	Good	Open tree, exposed by windthrow and site clearance but with good taper and conical form. Top 2 or 3 m appears to have been lost. Healthy foliage.	High	Remove	Conflicts with excavation for proposed underground parkade.	7.7
3289	On-Site	Douglas-Fir	Pseudotsuga menziesii	68	54	40-59%	6	Good	Tree at sheltered edge of stand. Poor to moderate taper. Symmetrical crown. Foliage healthy. Retain only in group.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.1
3290	On-Site	Western Red Cedar	Thuja plicata	38	21	60-79%	5	Moderate	Subdominant edge tree. Single stem. Symmetrical crown with good form.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	2.3
3291	On-Site	Douglas-Fir	Pseudotsuga menziesii	81	54	20-39%	5	Moderate	Tree in recently exposed group. Moderate taper. Moderate kink at 28 m. Crown asymmetrical to north east. Foliage healthy. Retain only in group.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.9
3292	On-Site	Douglas-Fir	Pseudotsuga menziesii	107	56	40-59%	5	Good	Dominant tree in recently exposed group. Good taper. Crown symmetrical. Foliage healthy.	High	Remove	Conflicts with excavation for proposed underground parkade.	6.4

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3293	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	76	56	20-39%	5	Moderate	Recently exposed at edge of group. Poor taper. Crown symmetrical. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.6
3300	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	78	54	20-39%	5	Moderate	Recently exposed at edge of group. Poor taper. Crown symmetrical. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.7
3302	On-Site	Western Hemlock	<i>Tsuga heterophylla</i>	93	45			Dead	Completely dead with sufficient decay for woodpecker activity in top half.	Nil	Remove	Conflicts with excavation for proposed underground parkade. Tree is also large, dead and unsuitable for retention in current context.	5.6
3304	On-Site	Western Red Cedar	<i>Thuja plicata</i>	43	15	80-100%	6	Moderate	From nurse log. Good taper. Healthy foliage.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.6
3305	On-Site	Western Red Cedar	<i>Thuja plicata</i>	57	15	20-39%	6	Poor	Top smashed.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.4
3306	On-Site	Western Red Cedar	<i>Thuja plicata</i>	30	15	40-59%	6	Poor	Leans 5 degrees north, likely from impact of falling trees.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3309	On-Site	Western Red Cedar	Thuja plicata	74	40	40-59%	5	Moderate	Recently exposed to west. Moderate taper. Narrow symmetrical crown. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.4
3310	On-Site	Western Red Cedar	Thuja plicata	33	21	40-59%	3	Poor	Suppressed.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.0
3312	On-Site	Western Red Cedar	Thuja plicata	53	38	40-59%	5	Moderate	Codominant tree. Poor taper. Crown asymmetrical to east.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.2
3313	On-Site	Western Red Cedar	Thuja plicata	42	36	40-59%	3	Moderate	Subdominant tree. Poor taper. Crown asymmetrical to east.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.5
3314	On-Site	Western Red Cedar	Thuja plicata	98	42	40-59%	5	Moderate	Recently exposed to west. Moderate taper. Narrow symmetrical crown. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	5.9
3315	On-Site	Western Red Cedar	Thuja plicata	116	42	40-59%	6	Moderate	Dominant tree. Recently exposed to west. Good taper. Symmetrical crown. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	7.0
3316	On-Site	Western Red Cedar	Thuja plicata	58	26	60-79%	5	Moderate	Partly suppressed. In contact with 337 at base. Crown heavily asymmetrical to west. Foliage healthy.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.5

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3317	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	102	56	40-59%	7	Good	Dominant in stand. Base in contact with 3316. Minor sweep in lower third of trunk. Good taper. Symmetrical crown. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	6.1
3318	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	104	48	40-59%	8	Good	Dominant in stand. Good taper. Symmetrical conical crown. Foliage healthy.	High	Remove	Conflicts with excavation for proposed underground parkade.	6.2
3319	On-Site	Western Red Cedar	<i>Thuja plicata</i>	37	26	60-79%	5	Moderate	Partly suppressed edge tree. Crown asymmetrical to east. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	2.2
3320	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	54	25	40-59%	6	Poor	Suppressed. Top lost.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.2
3321	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	112	56	40-59%	7	Good	Dominant in stand. Minor basal sweep. Good taper. Symmetrical crown. Foliage healthy. Retain only in group.	High	Remove	Conflicts with excavation for proposed underground parkade.	6.7
3322	On-Site	Western Hemlock	<i>Tsuga heterophylla</i>	25	18			Dead		Nil	Remove	Conflicts with excavation for proposed underground parkade. Tree is also dead.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3323	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	64	30	60-79%	6	Poor	Partly suppressed edge tree.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.8
3324	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	88	56	60-79%	6	Good	Dominant tree at edge of stand. Poor to moderate taper. Symmetrical crown. Foliage healthy. Retain only in group.	High	Remove	Conflicts with excavation for proposed underground parkade.	5.3
3325	On-Site	Western Red Cedar	<i>Thuja plicata</i>	68	36	80-100%	5	Moderate	Edge tree. Moderate taper. Crown asymmetrical to south east.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.1
3326	On-Site	Big-Leaf Maple	<i>Acer macrophyllum</i>	47	22	60-79%	4	Poor	Partly suppressed. Has previous scaffold branch loss, decay and large hung-up branch.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.8
3327	On-Site	Western Red Cedar	<i>Thuja plicata</i>	58	32	60-79%	5	Moderate	Subdominant edge tree. Moderate taper. Symmetrical crown.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.5
3328	On-Site	Western Red Cedar	<i>Thuja plicata</i>	62	32	60-79%	4	Poor	Subdominant tree. Has obvious advanced decay in butt.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.7
3329	On-Site	Black Cottonwood	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	97	38	60-79%		Moderate	Edge tree. No obvious stem defects. Scaffold branch unions unclear. Crown asymmetrical to east. Foliage healthy.	Low	Remove	Conflicts with excavation for proposed underground parkade.	5.8



Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3330	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	123	59	40-59%	9	Good	Dominant tree in recently exposed group. Good taper. Crown symmetrical. Foliage healthy.	High	Remove	Conflicts with excavation for proposed underground parkade.	7.4
3331	On-Site	Douglas-Fir	<i>Pseudotsuga menziesii</i>	113	57	40-59%	5	Good	Dominant tree in recently exposed group. Good taper. Crown narrow, symmetrical. Foliage healthy.	High	Remove	Conflicts with excavation for proposed underground parkade.	6.8
3332	On-Site	Western Red Cedar	<i>Thuja plicata</i>	69	34	40-59%	5	Moderate	Subdominant tree. Single stem, moderate taper. Crown thin.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.1
3333	On-Site	Western Red Cedar	<i>Thuja plicata</i>	75	42	60-79%	5	Moderate	Recently exposed to west. Damage to base from falling tree. Moderate taper. Crown asymmetrical to south west. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	4.5
3334	On-Site	Western Red Cedar	<i>Thuja plicata</i>	36	21	60-79%	5	Poor	Heavily suppressed. Crown asymmetrical to north.	Low	Remove	Conflicts with excavation for proposed underground parkade.	2.2
3335	On-Site	Western Red Cedar	<i>Thuja plicata</i>	112	42	60-79%	5	Moderate	Recently exposed to west. Moderate taper. Basal flare to 3 m, may indicate internal decay column. Crown asymmetrical to south west. Foliage density moderate.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	6.7

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
3336	On-Site	Western Red Cedar	Thuja plicata	132	40	80-100%	6	Moderate	Anchor tree on edge of stand. Open grown, two stems from acute union at base. Crown slightly asymmetrical to east. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	7.9
3337	On-Site	Western Red Cedar	Thuja plicata	104	40	80-100%	5	Moderate	Anchor tree on edge of stand. Open grown, single stem, good taper. Crown slightly asymmetrical to east. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	6.2
3338	On-Site	Western Red Cedar	Thuja plicata	61	40	60-79%	5	Moderate	Sheltered edge tree. Poor taper. Narrow symmetrical crown. Foliage density low.	Low	Remove	Conflicts with excavation for proposed underground parkade.	3.7
3339	On-Site	Western Red Cedar	Thuja plicata	75	40	60-79%	5	Moderate	Sheltered edge tree. Moderate taper. Crown heavily asymmetrical to east. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.5
3340	On-Site	Western Red Cedar	Thuja plicata	76	40	60-79%	5	Moderate	Sheltered edge tree. Moderate taper. Subdominant leader from poor unions at 25 m. Crown heavily asymmetrical to east. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.6
3341	On-Site	Western Red Cedar	Thuja plicata	79	40	60-79%	5	Good	Survey location is wrong. Codominant tree in stand. Moderate taper. Symmetrical crown. Foliage healthy.	Medium	Remove	Conflicts with excavation for proposed underground parkade.	4.7
3342	On-Site	Western Red Cedar	Thuja plicata	96	40	60-79%	5	Moderate	Recently exposed to west. Moderate taper. Crown asymmetrical to south west. Foliage density moderate.	Low	Remove	Conflicts with excavation for proposed underground parkade.	5.8

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
UBC01	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	10	5	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0
UBC02	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	11	6	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
UBC03	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	12	7	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0
UBC04	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	10	5	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0

Tag #	Location	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/Remove	Retention/TPZ Comments	*TPZ (m)
UBC05	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	11	6	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0
UBC06	UBC - Boulevard	Katsura	Cercidiphyllum japonicum	10	5	60-79%	2	Good	In boulevard. Moderate root zone compaction from path. Good form. Healthy.	Medium	Retain	Any works to occur within TPZ must occur under arborist supervision. This includes potential upgrades to existing hardscaping, landscaping and irrigation installation.	2.0

## Appendix 2 Site Photographs



Photo 1. Overview of the on-site stand from the west. Dead hemlock number 3302 is in the center of shot.



Photo 2. Overview of the on-site stand from the south east.



Photo 3. Example of windthrow failure of a large tree in the on-site stand.





Photo 4 Tree 3288 exposed by windthrow and clearance that has good trunk taper and crown form in this open context.

## Appendix 3 Tree Health and Structure Rating Criteria

The tree health and structure ratings used by Diamond Head Consulting summarize each tree based on both positive and negative attributes using five stratified categories. These ratings indicate health and structural conditions that influence a tree's ability to withstand local site disturbance during the construction process (assuming appropriate tree protection) and benefit a future urban landscape.

**Excellent:** Tree of possible specimen quality, unique species or size with no discernible defects.

**Good:** Tree has no significant structural defects or health concerns, considering its growing environment and species.

**Moderate:** Tree has noted health and/or minor to moderate structural defects. This tree can be retained, but may need mitigation (e.g., pruning or bracing) and monitoring post-development. A moderate tree may be suitable for retention within a stand or group, but not suitable on its own.

**Poor:** Tree is in serious decline from previous growth habit or stature, has multiple defined health or structural weaknesses. It is unlikely to acclimate to future site use change. This tree is not suitable for retention within striking distance of most targets.

**Dying/Dead:** Tree is in severe decline, has severe defects or was found to be dead.

## Appendix 4 Tree Retention Value Rating Criteria

The tree retention value ratings used by Diamond Head Consulting provide guidance for tree retention planning. Each tree in an inventory is assigned to one of four stratified categories that reflect its value as a future amenity and environmental asset in a developed landscape. Tree retention value ratings take in to account the health and structure rating, species profile\*, growing conditions and potential longevity assuming a tree's growing environment is not compromised from its current state.

**High:** Tree suitable for retention. Has a good or excellent health and structure rating. Tree is open grown, an anchor tree on the edge of a stand or dominant within a stand or group. Species of *Populus*, *Alnus* and *Betula* are excluded from this category.

**Medium:** Tree suitable for retention with some caveats or suitable within a group\*\*. Tree has moderate health and structure rating, but is likely to require remedial work to mitigate minor health or structural defects. Includes trees that are recently exposed, but wind firm, and trees grown on sites with poor rooting environments that may be ameliorated.

**Low:** Tree has marginal suitability for retention. Health and structure rating is moderate or poor; remedial work is unlikely to be viable. Trees within striking distance of a future site developments should be removed.

**Nil:** Tree is unsuitable for retention. It has a dying/dead or poor health and structure rating. It is likely that the tree will not survive, or it poses an unacceptable hazard in the context of future site developments.

\* The species profile is based upon mature age and height/spread of the species, adaptability to land use changes and tree species susceptibility to diseases, pathogen and insect infestation.

\*\* Trees that are 'suitable as a group' have grown in groups or stands that have a single, closed canopy. They have not developed the necessary trunk taper, branch and root structure that would allow them to be retained individually. These trees should only be retained in groups.

## Appendix 5 Risk Rating Matrices

Trees with a *probable* or *imminent* likelihood of failure, a *medium* or *high* likelihood of impacting a specified target, and a *significant* or *severe* consequence of failure have been assessed for risk and included in this report (Section 3.2). These two risk rating matrices showing the categories used to assign risk are taken without modification to their content from the International Society of Arboriculture Tree Risk Assessment Qualification Manual.

**Matrix 1: Likelihood**

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

**Matrix 2: Risk Rating**

Likelihood of Failure and Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

## Appendix 6 Construction Guidelines

Tree management recommendations in this report are made under the expectation that the following guidelines for risk mitigation and proper tree protection will be adhered to during construction.

Respecting these guidelines will prevent changes to the soil and rooting conditions, contamination due to spills and waste, or physical wounding of the trees. Any plans for construction work and activities that deviate from or contradict these guidelines should be discussed with the project arborist so that mitigation measures can be implemented.

### Tree Protection Zones

A Tree protection zone (TPZ) is determined using either dripline or a DBH multiplier to define a radius measured in all directions from the outside of a tree's trunk. It is typically determined according to local municipal bylaw specifications and may be modified based on professional judgement of the project arborist to accommodate species specific tolerances and site specific growing conditions. For retained trees, the TPZ and fencing indicated in this report are proposed as suitable in relation to the level of disturbance proposed on the site plan provided to the project arborist. Arborist consultation is required if any additional work beyond the scope of the plans provided is proposed near the tree. Work done in addition to the proposed impacts discussed in this report may cause the tree to decline and die.

Tree Protection Fencing: Tree protection zones (TPZs) will be protected by Tree Protection Fencing except where site features constrict roots (e.g., retaining walls or roads), where continual access is required (e.g., sidewalks), or when an acceptable encroachment into the TPZ is proposed, in which case the fencing will be modified. Tree Protection Fencing is shown on the Tree Protection Plan and, where it varies from the TPZ, the rationale is described in the inventory table in Section 3.1.

Within a TPZ, no construction activity, including materials storage, grading or landscaping, may occur without project arborist approval. Within the TPZ, the following are tree preservation guidelines based on industry standards for best practice and local municipal requirements:

- No soil disturbance or stripping.
- Maintain the natural grade.
- No storage, dumping of materials, parking, underground utilities or fires within TPZs or tree driplines.
- Any planned construction and landscaping activities affecting trees should be reviewed and approved by a consulting arborist.
- Install specially designed foundations and paving when these structures are required within TPZs.
- Route utilities around TPZs.
- Excavation within the TPZs should be supervised by a consultant arborist.
- Surface drainage should not be altered in such a way that water is directed in or out of the TPZ.

- Site drainage improvements should be designed to maintain the natural water table levels within the TPZ.

Prior to any construction activity, Tree Protection Fencing must be constructed as shown on the Tree Protection Plan. The protection barrier or temporary fencing must be at least 1.2 m in height and constructed of 2" by 4" lumber with orange plastic mesh screening. Tree Protection Fencing must be constructed prior to tree removal, excavation or construction and remain intact for the entire duration of construction.

### **Tree Crown Protection and Pruning**

All heavy machinery (excavators, cranes, dump trucks, etc.) working within five meters of a tree's crown should be made aware of their proximity to the tree. If there is to be a sustained period of machinery working within five meters of a tree's crown, a line of colored flags should be suspended at eye-level of the machinery operator for the length of the protected tree area. Any concerns regarding the clearance required for machinery and workers within or immediately outside tree protection zones should be referred to the project arborist so that a zone surrounding the crowns can be established or pruning measures undertaken. Any wounds incurred to protected trees during construction should be reported to the project arborist immediately.

### **Unsurveyed Trees**

Unsurveyed trees identified by DHC in the Tree Retention Plan have been hand plotted for approximate location only using GPS coordinates and field observations. The location and ownership of unsurveyed trees cannot be confirmed without a legal survey. The property owner or project developer must ensure that all relevant on- and off-site trees are surveyed by a legally registered surveyor, whether they are identified by DHC or not.

### **Removal of logs from sites**

Private timber marks are required to transport logs from privately-owned land in BC. It is property owner's responsibility to apply for a timber mark prior to removing any merchantable timber from the site. Additional information can be found at: <http://www.for.gov.bc.ca/hth/private-timber-marks.htm>

### **Regulation of Soil Moisture and Drainage**

Excavation and construction activities adjacent to TPZs can influence the availability of moisture to protected trees. This is due to a reduction in the total root mass, changes in local drainage conditions, and changes in exposure including reflected heat from adjacent hard surfaces. To mitigate these concerns the following guidelines should be followed:

- Soil moisture conditions within the tree root protection zones should be monitored during hot and dry weather. When soil moisture is inadequate, supplemental irrigation should be provided that penetrates soil to the depth of the root system or a minimum of 30 cm.
- Any planned changes to surface grades within the TPZs, including the placement of mulch, should be designed so that any water will flow away from tree trunks.

- Excavations adjacent to trees can alter local soil hydrology by draining water more rapidly from TPZs more rapidly than it would prior to site changes. It is recommended that when excavating within 6 m of any tree, the site be irrigated more frequently to account for this.

### **Root Zone Enhancements and Fertilization**

Root zone enhancements such as mulch, and fertilizer treatments may be recommended by the project arborist during any phase of the project if they deem it necessary to maintain tree health and future survival.

### **Paving Within and Adjacent to TPZs**

If development plans propose the construction of paved areas and/or retaining walls close to TPZs, measures should be taken to minimize impacts. Construction of these features would raise concerns for proper soil aeration, drainage, irrigation and the available soil volume for adequate root growth. The following design and construction guidelines for paving and retaining walls are recommended to minimize the long-term impacts of construction on protected trees:

- Any excavation activities near or within the TPZ should be monitored by a certified arborist. Structures should be designed, and excavation activities undertaken to remove and disturb as little of the rooting zone as possible. All roots greater than 2 cm in diameter should be hand pruned by a Certified Arborist.
- The natural grade of a TPZ should be maintained. Any retaining walls should be designed at heights that maintain the existing grade within 20 cm of its current level. If the grade is altered, it should be raised not reduced in height.
- Compaction of sub grade materials can cause trees to develop shallow rooting systems. This can contribute to long-term pavement damage as roots grow. Minimizing the compaction of subgrade materials by using structural soils or other engineered solutions and increasing the strength of the pavement reduces reliance on the sub-grade for strength.
- If it is not possible to minimize the compaction of sub-grade materials, subsurface barriers should be considered to help direct roots downward into the soil and prevent them from growing directly under the paved surfaces.

### **Plantings within TPZs**

Any plans to landscape the ground within the TPZ should implement measures to minimize negative impacts on the above or below ground parts of a tree. Existing grass layer in TPZs should not be stripped because this will damage surface tree roots. Grass layer should be covered with mulch at the start of the project, which will gradually kill the grass while moderating soil moisture and temperatures. Topsoil should be mixed with the mulch prior to planting of shrubs, but new topsoil layer should not be greater than 20 cm deep on top of the original grade. Planting should take place within the newly placed topsoil mixture and should not disturb the original rooting zone of the trees. A two-meter radius around the base of each tree should be left unplanted and covered in mulch; a tree's root collar should remain free from any amendments that raise the surface grade.

### **Monitoring during construction**

Ongoing monitoring by a consultant arborist should occur for the duration of a development project. Site visits should be more frequent during activities that are higher risk, including the first stages of construction when excavation occurs adjacent to the trees. Site visits will ensure contractors are respecting the recommended tree protection measures and will allow the arborist to identify any new concerns that may arise.

During each site visit the following measures will be assessed and reported on by a consulting arborist:

- Health and condition of protected trees, including damage to branches, trunks and roots that may have resulted from construction activities, as will the health of. Recommendations for remediation will follow.
- Integrity of the TPZ and fencing.
- Changes to TPZ conditions including overall maintenance, parking on roots, and storing or dumping of materials within TPZ. If failures to maintain and respect the TPZ are observed, suggestions will be made to ensure tree protection measures are remediated and upheld.
- Review and confirmation of recommended tree maintenance including root pruning, irrigation, mulching and branch pruning.
- Changes to soil moisture levels and drainage patterns; and
- Factors that may be detrimentally impact the trees.



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