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Arborist Impact Assessment and Root Mapping
Re: Proposed Rezoning, Development, and Construction at 3106 Washington Ave., Victoria, BC

Author: Ryan Senechal MUFL, ISA TRAQ/ON-1272AT, BC WDTA
May 9th, 2024
Revised: January 29th, 2025

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For Danielle and Todd Buchanan
3106 Washington Ave. Victoria BC V9A 1P6
Re. Arborist Impact Assessment at 3106 Washington Ave.

1.0 Scope of Work

D. Clark Arboriculture has been retained by Danielle and Todd Buchanan to review impacts to Sequoia tree #201 and to provide recommendations relating to the proposed placement and size of "House #4". This investigation was conducted in response to review comments provided to our client from City of Victoria Parks on March 19th, 2024.

- An initial site visit was completed on May 3rd, 2024 to observe and document tree #201, the soil texture and moisture, and the general conditions of the site.
- Exploratory excavation was completed on January 24th, 2025
- Trench locations, root locations, and root sizes were collected and documented on January 29th, 2025

Summary

A site visit (May 3rd, 2024) and additional background gathered have informed recommendations provided in the Arborist Impact Assessment report produced on May 9th, 2024. This assignment was intended to determine if tree #201 was suitable to be retained relative to House #4's proposed location and dimensions as submitted (Site Plans, Zebra Designs 2022). The subject Sequoia's species profile, the species tolerance to construction and pruning, the present growing conditions, and current tree vitality have all been evaluated. A revision to the Arborist Impact Assessment report (May 9th, 2024) was produced following exploratory excavation (i.e., root mapping) that was completed on January 24th, 2025.

Trenching using pneumatic soil excavation (i.e., AirSpade®) at the edge of excavation extents outlined in plans provided to us indicated that few large roots were present. This evidence gathered supports the previous Arborist Impact Assessment report findings that Sequoia tree #201 will be provided adequate soil and root system relative to the project designs as presently proposed. The implementation of a Specified Tree Protection Zone (STPZ) and low branch pruning will allow the Sequoia tree to be retained through development with tree health and tree stability being minimally affected. The tree health and tree stability outcomes are dependent on the implementation of arboricultural management guidelines outlined in the Arborist Report (D. Clark Arboriculture, revised July 24, 2024) and Tree Management Plan (D. Clark Arboriculture, revised July 23, 2024).

2.0 Introduction and Methodology

A detailed assessment of one on-property *Sequoiadendron giganteum* tree was performed to evaluate tolerance to planned construction activities within a 12x multiplication factor Calculated Tree Protection Zone (TPZ). The basis for a 12x Calculated Tree Protection Zone (CTPZ) stems from a common starting point in development on small urban lots where arboricultural management will be applied. The factor of CTPZ is then refined based on the evidence gathered during the assessment of the tree, for example, species tolerance to root and branch injury, species growth habits, tree vitality, structural condition, tree allometry, and growing conditions are important factors to consider in determining what Calculated Tree Protection Zone is appropriate. House #3 and #4's planned footprints and shared driveway are situated inside of a 12x radius multiplication factor of the tree's diameter at breast height. This assignment investigated 1) the possibility of retaining the Sequoia tree through development based on designs provided to us, and 2) defining an appropriate CTPZ factor that balances the construction of housing with the long-term benefits potentially provided by retaining the tree.

Table 1. Inventory summary of tree #201.

#	Species	DBH (cm)	Height (m)	Spread (m)	TPZ (m)	Vitality Rating	Structural Condition Rating
201	*Sequoiadendron giganteum*	116	15	12	14	Good	Good

DBH: Diameter at Breast Height. Measured at 1.4m from the point of germination.
TPZ: Tree Protection Zone. The base TPZ shall be a radius of 12x the DBH.

2.1 Methods

The assessment was based at ground level, and at height using a micro drone.

Pneumatic soil excavation was conducted using an AirSpade®.

Measurements were collected using a standard fabric diameter tape and a TruPulse 200L rangefinder.

Photographs were captured using a OnePlus 11 mobile phone (Hasselblad/Sony IMX890 24mm).

Geolocations of exploratory trenches and roots exposed were captured using Trimble Catalyst software (60 cm license) and a Trimble DA2 GNSS receiver. Accuracy was maintained at 60-70 cm.

Micro-drone (>250 g) operations were conducted in accordance with Transport Canada micro-drone requirements and flight information was logged in NAV Canada's NAV Drone app. The flight proceeded under Transport Canada micro-drone guidelines. The aerial survey flight did not exceed a flight level of 50 m.

3.0 Impact Analysis

3.1 Growing conditions

Investigations of the 12x TPZ surrounding tree #201 included a tree, adjacent vegetation, and soil survey. Surrounding vegetation was primarily turfgrass outside of the densely branched Sequoia with patches of Himalayan blackberry (established at the property fences on the north and west sides of the tree).

A soil auger was used to draw a 45 cm depth sample to determine relative texture and moisture during my site visit on May 3rd, 2024. I was able to easily reach 45 cm depth by taking two plugs with a Dutch auger, and the combined plugs were a sandy loam texture (*Figure 1-2*). Moisture through the sample was even. Rainfall for the month of April 2024 amounted to 29.2 mm[1] which is well below the 2000-2024 average of 77mm[2].

Figure 1. Soil auger sample location (150° heading at dripline)

Figure 2. Soil texture and moisture sample

3.2 Tree vitality

The tree's vitality rating (the tree's overall ability to tolerate stress) was rated at 90%. Live foliage is dense across the entire outer crown and it is growing vigorously vertically and laterally. A color difference was observed in the upper 50% of the crown, and this may be new growth emerging. Secondary growth has been rapid evidenced by the substantial trunk girth (1.76 m ⌀ at base) and relatively young age (Figure 3). Branch removal pruning on the lower trunk was visible and minor in size and quantity. Disturbance to the soil and root system occurred within the last 4 years related to a development at 3120 Washington Avenue: the extent of disturbance and injury is unknown.

Comparative analysis of Victoria Maps orthographic images from 2005 and 2023 suggests the age class of tree #201 is semi-mature, or a tree that has lived less than 40% of its expected lifespan). Using GIS

[1] Environment Canada. 2024. Historical Data – Climate.
[2] The Weather Network. 2024. Historical Monthly Averages.

measurements comparing the same images enables us to estimate that this tree was planted in the mid 1990s.

Figure 3. 2005 Ortho Imagery (Victoria Maps)

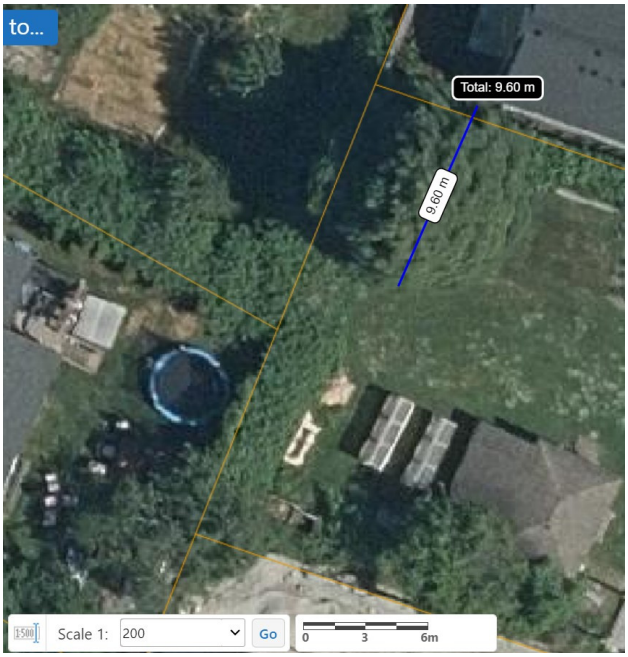


Figure 4. 2023 Ortho Imagery (Victoria Maps)

3.3 Species profile

Giant Sequoia is well adapted for long periods of summer drought and demonstrates a high tolerance of degraded urban soils in the Greater Victoria Area. The species is listed as suitable as an urban tree for all but the driest sites in an anticipated future climate[3]. Mature trees are shade intolerant and form high crowns in forest stands where lower branches die from lack of light[4]. Open grown trees with available light on all sides are prone to form low branching, and this is the case with tree #201.

[3] Metro Vancouver. Urban Tree List for Metro Vancouver in a Changing Climate.
[4] Habeck, R. J. 1992. *Sequoiadendron giganteum.* U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Figure 5. Sequoia, 1505 Bywood Pl.

Figure 6. Sequoia, Saanich Peninsula Hospital

Where urban Sequoia trees' vitality is strong, tolerance to low branch pruning around conflicting infrastructure is high: Sequoiadendron has high resistance to decay fungi[5] and is an effective compartmentalizer of wounding. Numerous local examples of mature giant Sequoia in highly built-up areas demonstrate a tolerance for a range of pruning treatments as they mature around urban infrastructure and adapt around introduced infrastructure (Figures 5-8). Dozens of giant Sequoia have persisted through phases of private development and public infrastructure changes since turn of the early 1900's when they were introduced to the region[6] (Figures 5-8).

Figure 7. Sequoia, 250 Douglas st. (Google)

Figure 8. Sequoia, Campus Honda (Google)

[5] Piirto, Douglas D. 1986. Wood of Giant Sequoia: Properties and Unique Characteristics.
[6] Chaster, G.H., Ross, D.W., Warren, W.H. 1988. Trees of Greater Victoria: A Heritage.

3.4 Tree allometry and structural condition

The tree is relatively short (15 m) with a 12 m ⌀ symmetrical crown and substantial basal trunk buttressing (1.76 m ⌀). Root injuries (quantity of root loss or individual loss of large anchoring roots) should be minimized through the implementation of arboricultural guidance included in the Arborist Report and Tree Management Plan. Single stand-alone trees are the ideal tree retention opportunity through development because of uniform canopy and well-formed trunk taper[7].

A pruning plan to establish and maintain building and driveway clearance should establish a lowest permanent branch. This can be targeted at the height where branching growth habit shifts from downward to horizontal growth (laser measured at 5.5m height). Pruning will use a combination of reduction and removal pruning methods targeting the most vigorous and elongated branches and retaining subordinate branches. This pruning will have a low impact to the tree's vitality rating as it is gradual and localized to 5 m height covering 33% of the radius of the tree. Pruning should be performed by an ISA Certified Arborist familiar with giant Sequoia, or a trainee arborist under the direct an ongoing supervision of an ISA Certified Arborist.

3.5 Specified Tree Protection Zone (STPZ)

ISA Best Management Practices establish acceptable scenarios for a specified approach of CRZ multiplication factors where planned construction cannot be located beyond a preferred CRZ[8]. There are limitations on how much crown or root loss a tree can tolerate, and the field work conducted for this assignment was intended to investigate if a Specified Tree Protection Zone (STPZ) approach would be appropriate. Quantitative information is in short supply specific to tree speceies' response to construction impacts. Assigning species suitability ratings is a qualititative process based on consultant observations of tree response[9]. Sequoia's species tolerance to construction is suggested to be moderate (*Table 2)*, however, personal observations and observations of local consulting arborist colleagues suggest Sequoia has a high tolerance of construction in the Greater Victoria area.

Table 2. Guidelines for calculating tree protection zone radius for trees in good condition (ISA Best Management Practices: Managing Trees During Site Development and Construction)

Species Tolerance to Construction Damage	Relative Tree Age	TPZ Multiplication Factor
Moderate	Semi-mature	8

[7] Matheny, N., Clark, J.R. 1998. Trees and Development: A Technical Guide to Preservation of Trees During Land Development.

[8] Matheny et al. 2023. Managing Trees During Site Development and Construction: Best Management Practices. Third Edition.

[9] Matheny, N., Clark, J.R. 1998. Trees and Development: A Technical Guide to Preservation of Trees During Land Development.

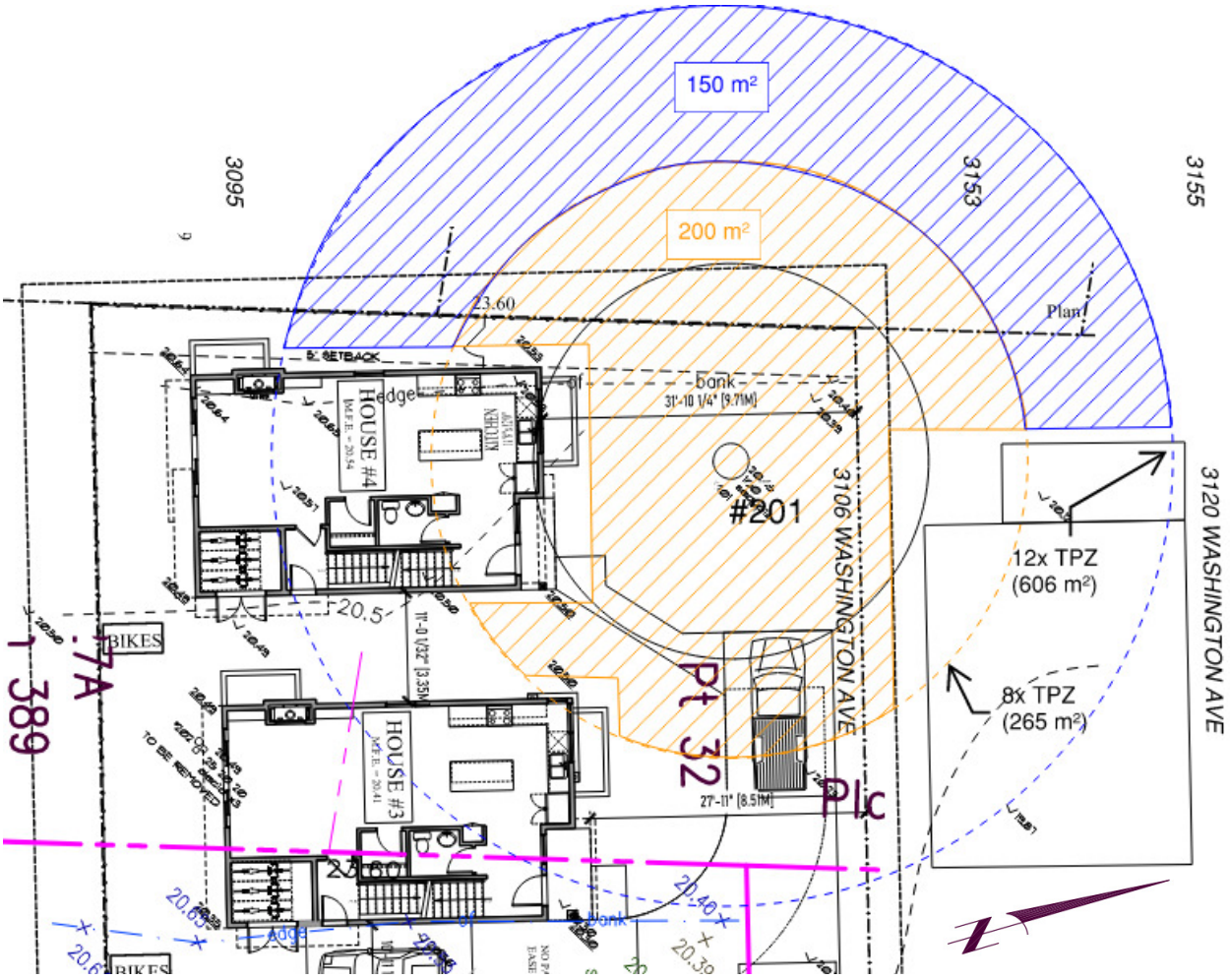


Figure 9. Specified Tree Protection Zone (hatched areas), tree #201

3.6 Anticipated root injury and soil disturbance

Aerial imagery reviewed indicates that development disturbance occurred beginning in ~2021 on the adjacent lot (3120 Washington Ave.). The disturbance to tree #201 at 3120 Washington Ave. occurred inside of an 8x TPZ multiplication factor (headings 120°-30°) although background information on the extent of soil loss or root injury that might have occurred was not available to us in the preparation of this report. No foliar injury was visible on tree #201 associated with the development activities on the adjacent lot during my site visit. On the other hand, such injuries may present several years following injury.

Designs provided to us by our client suggest that without any arboricultural management, a maximum of 25% of the total soil and root system radius at 3106 Washington Ave. is exposed to disturbance within an 8x TPZ multiplication factor (headings 120°-210°).

Relative to House #4 and driveway designs provided to us, the subject Sequoia's species profile, the species tolerance to construction and pruning, the present growing conditions, and current tree vitality have all been evaluated. A 12x multiplication TPZ factor applied as a full circle covers an area of 606 m². Using the STPZ approach (Figure 9) with the existing Tree Management Plan will preserve 350 m² or 57%

of a 12x TPZ soil/root system area. Within an 8x TPZ area scenario, 75% of the soil and root system is protected.

3.7 Exploratory excavation

Exploratory excavation (i.e., root mapping) was conducted on January 24th, 2025, using pneumatic soil excavation to locate roots and determine the root location, size, and quantity. Layout of the survey area was primarily focused on the edge of a proposed excavation cut north side of proposed houses #3 and 4, running from east to west, 8 m from the north property line. Low branch pruning was conducted to enable the technician to access the trench layout within the dripline of the tree. The locations of the two exploratory trenches are referenced in *Figure 10* and *Figure 13*.

All roots larger than 2.5 cm ⌀ exposed were geolocated (*Figure* 13) and inventoried in *Table 3*. The maximum depth of exploratory excavation was 60 cm as the bulk of fibrous and structural roots were observed in the upper 45 cm of the soil profile. Small fibrous roots were quite dense within the tree's dripline, and relatively few larger roots (>2.5 cm ⌀) were encountered across the 12 m trench span running from east to west. A second trench was exposed running 9 m in length from north to south, and only fibrous roots were observed.

Figure 10. Aerial photo of exploratory excavation (obtained January 29, 2025).

Figure 11. Aerial photo of exploratory excavation (obtained January 29, 2025) facing west.

Figure 12. View of west side of exploratory trench and root locations 9, 8, and 7 (from left to right).

Figure 13. Aerial photo of exploratory excavation (obtained January 29, 2025), root locations, and root size.

Table 3. Exploratory excavation root inventory

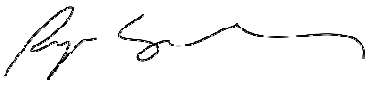
Root #	Root heading from trunk (°)	Root ⌀ (cm)	Distance of root to trunk (m)	Approximate CTPZ factor
1	110	3	10.6	9
2	120	2.5	7.5	6.5
3	120	2.5	7.3	6.5
4	120	2.5	7	6
5	135	5	4.6	4
6	160	2.5	3.8	3.5
7	160	2.5	3.6	3
8	180	6	3.4	3
9	180	10	3.4	3

4.0 Recommendations

Based on the limited abundance and relatively small size of roots exposed, root pruning to accommodate proposed House #4 (as designed) is anticipated to have minimal effect on tree health and tree stability. A total of 3 roots exposed were larger than 5 cm ⌀ at the point where pruning would be required. The largest of those roots exposed was 10 cm ⌀. Site soil depth and volume appears to be ideal for the Sequoia to respond to this minimal amount of root pruning.

The implementation of arboricultural management guidelines outlined in the Arborist Report (D. Clark Arboriculture, June 2023) and revised Tree Management Plan (D. Clark Arboriculture, November 2023) will provide adequate soil and root system protection for a long-lived Sequoia tree using the STPZ approach outlined in this report. Branch pruning to provide required clearance for the driveway and building is unlikely to affect the tree's overall vitality if the treatment is localized as prescribed in part 3.4 of this report.

Thank you for the opportunity to comment on these trees.
Should any issues arise from this report, I am available to discuss them by phone, email or in person.
Regards,



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Disclosure Statement

An arborist uses their education, training and experience to assess trees and provide prescriptions that promote the health and wellbeing, and reduce the risk of trees.

The prescriptions set forth in this report are based on the documented indicators of risk and health noted at the time of the assessment and are not a guarantee against all potential symptoms and risks.

Trees are living organisms and subject to continual change from a variety of factors including but not limited to disease, weather and climate, and age. Disease and structural defects may be concealed in the tree or underground. It is impossible for an arborist to detect every flaw or condition that may result in failure, and an arborist cannot guarantee that a tree will remain healthy and free of risk.

To live near trees is to accept some degree of risk. The only way to eliminate the risks associated with trees is to eliminate all trees.

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