FORM 1

Riparian Areas Protection Regulation - Qualified Environmental Professional - Assessment Report

# Riparian Areas Protection Regulation: Assessment Report

Please refer to submission instructions and assessment report guidelines when completing this report.

Date: September 23, 2024

## I. Primary QEP Information

| | | | | |
|---|---|---|---|---|
| First Name | Susan | Middle Name | | |
| Last Name | Blundell | | | |
| Designation | R.P.Bio. | Company | WSP Canada Inc. | |
| Registration # | 1862 | Email | susan.blundell@wsp.com | |
| Address | [redacted]3600 Uptown Boulevard | | | |
| City | Victoria | Postal/Zip | V8Z 0B9 | Phone # 250-360-3578 |
| Prov/state | BC | Country | Canada | |

## II. Secondary QEP Information (use **Form 2** for other QEPs)

| | | | | |
|---|---|---|---|---|
| First Name | Bruce | Middle Name | | |
| Last Name | Crawshaw | | | |
| Designation | P.Eng | Company | Westbrook Consulting Ltd. | |
| Registration # | 34491 | Email | bcrawshaw@wbrook.ca | |
| Address | [redacted]866 Goldstream Avenue | | | |
| City | Victoria | Postal/Zip | V9B 0J3 | Phone # 250-391-8592 |
| Prov/state | BC | Country | Canada | |

## III. Developer Information

| | | | |
|---|---|---|---|
| First Name | Frank | Middle Name | |
| Last Name | Limshue | | |
| Company | WestUrban Developments Ltd. | | |
| Phone # | [redacted] | Email | flimshue@westurban.ca |
| Address | 96 Wallace Street | | |
| City | Nanaimo | Postal/Zip | V9R 0E2 |
| Prov/state | BC | Country | Canada |

## IV. Development Information

| | | | |
|---|---|---|---|
| Development Type | Construction: High Density | | |
| Area of Development (ha) | 0.50 | Riparian Length (m) | 755 |
| Lot Area (ha) | 0.86 | Nature of Development | New |
| Proposed Start Date | 2025-06-01 | Proposed End Date | 2026-12-31 |

## V. Location of Proposed Development

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Street Address (or nearest town) | 3601 Olympian Way | | | | | | |
| Local Government | City of Colwood | | | City | Victoria | | |
| Stream Name | Latoria Creek; Unnamed Tributary; ungazetted tributary to Latoria Creek | | | | | | |
| Legal Description (PID) | 031-260-250 | | | Region | Vancouver Island | | |
| Stream/River Type | Wetland | | | DFO Area | South Coast | | |
| Watershed Code | 920-031900 | | | | | | |
| Latitude | 48 | 24 | 26.60 | Longitude | 123 | 30 | 32.34 |

Make duplicates of the complete form fields and paste below each other for additional QEPs

**II. Additional QEP Information**

| | | | | |
|---|---|---|---|---|
| First Name | Margaret | | Middle Name | |
| Last Name | Symon | | | |
| Designation | Professional Forester (RPF) | | Company Strathcona Forestry Consulting | |
| Registration # | 1485 A.B.C. | Email | | |
| Address | PO Box 387 Stn Mn | | | |
| City | Duncan | Postal V8Z 1T2 | Phone # 250-475 | |
| Prov/state | B.C. | Country Canada | | |

Make duplicates of the complete form fields and paste below each other for additional QEPs

**II. Additional QEP Information**

| | | | | |
|---|---|---|---|---|
| First Name | Austin | | Middle Name | |
| Last Name | Baird | | | |
| Designation | Professional Engineer (PEng) | | Company Ryzuk Geotechnical | |
| Registration # | 60444 | Email mail@ryzuk.com | | |
| Address | [redacted]40 Cadillac Avenue | | | |
| City | Victoria | Postal V8Z 1T2 | Phone # 250-475-3131 | |
| Prov/state | B.C. | Country Canada | | |

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## *Section 1. Description of Fisheries Resources Values and a Description of the Development proposal*

**Proposed Development**

The residential development at 3601 Olympian Way property is located in the City of Colwood, B.C. and includes a 90-unit purpose-built rental apartment building. The site is part of the Olympic View master planned development and is already zoned to permit the proposed development. The parcel is subject the Form and Character, and Environmental development areas. Access to the site will be from Olympian Way.

Stormwater management will consist of on-site infiltration and storage, an oil-grit separator and a connection to the existing stormwater infrastructure located at the north end of the Site off of Latoria Road.

The Site will be fully serviced by gravity for sewer and will be connected to the Capital Regional District water system. The schedule for the commencement of the construction is proposed for June 2025 and the development should take approximately 1.5 years to complete.

**Aquatic Resources**

The aquatic resources present on Site are located within the Latoria Creek watershed which covers an approximate area of 404 ha encompassing predominantly the City of Colwood, but also to a lesser extent portion of the City of Langford and the District of Metchosin. The headwaters to this system are located to the west and north of the intersection of Veteran's Memorial Parkway (VMP) and Latoria Road.

A portion of a wetland (and its associated Streamside Protection and Enhancement Area) is located in the southeast corner of the Site which is part of the wetland complex that comprises the headwaters for Latoria Creek (WSC 920-031900). The wetland is a part treed swamp and part shallow open water that consists of obligative and facultative wetland plants including skunk cabbage (*Lysichiton americanus*), Nootka rose (*Rosa nutkana*), slough sedge (*Carex obnupta*), hardhack (*Spiraea douglasii*), Pacific willow (*Salix lasiandra*), red-osier dogwood (*Cornus sericea*) and Pacific crabapple (*Malus fusca*). Riparian vegetation consists of western redcedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) with an understorey of salmonberry (*Rubus spectabilis*), red elderberry (*Sambucus racemosa*), salal (*Gaultheria shallon*), dull Oregon-grape (*Berberis nervosa*), bracken (*Pteridium aquilinum*), lady fern (*Athyrium filix-femina*) and sword fern (*Polystichum munitum*). The wetland outlet channel flows to the north northeast through the Creekview residential development and across Latoria Road (at Creekview Lane) where is flows to the east along the north side of the road for a length of approximately 900 m before the watercourse crosses south under Latoria Road (at Wishart Road) and flows southeast and enters Latoria Creek Park. Latoria Creek enters

a ravine approximately 100 m downstream. Latoria Creek flows in a south-southeast direction for a distance of 950 m before discharging under Metchosin Road. Latoria Creek flows for a further 150 m south until it discharges into a man-modified water body. The stream then flows southeast for 220 m before entering the estuary at Albert Head Lagoon.

**Fisheries Resources**

There are three fish migration barriers on Latoria Creek located south of Metchosin Road; one at the culvert under Metchosin Road and two approximately 100m south of Metchosin Road north and south of a residential pond off Duke Road. Another fish barrier (waterfall) was noted on Latoria Creek approximately 80 m upstream from Metchosin Road.

A review of previous occurrence records identified three fish species within the Study Area).

Table 1: Summary of Historical Fish Presence within the Study Area

| | | STATUS | | | |
|---|---|---|---|---|---|
| COMMON NAME | SCIENTIFIC NAME | SARA[1] | COSEWIC[2] | BC LIST[3] | PROVINCIAL STATUS[4] |
| Cutthroat trout | *Oncorhynchus clarki lewisii* | 1-SC (2010) | SC | Blue | S2S3 (2018) |
| Prickly sculpin | *Cottus asper* | N/A | N/A | Yellow | S5 (2019) |
| Threespine stickleback | *Gasterosteus aculeatus* | N/A | N/A | Yellow | S5 (2018) |

(1) SARA: Federal SARA Schedule number (1-3) for this species. See the SARA website for more information (Government of Canada, 2023). E = Endangered, T = Threatened, SC = Special Concern, NA = Not Assessed.
(2) COSEWIC: rank is followed by the date the rank was last reviewed. E = Endangered; T = Threatened; SC = Special Concern; NAR = Not at Risk; NA = Not Assessed (Government of Canada, 2023).
(3) BC List: The provincial list to which the species is assigned based on the BC CDC (2023). Red: any indigenous species or subspecies that is extirpated, endangered, or threatened in BC; Blue: any indigenous species or subspecies considered to be of special concern in BC, but is not extirpated, endangered, or threatened; Yellow: any indigenous species or subspecies considered secure in BC – encompasses all not listed as red or blue.
(4) Provincial Status: Provincial ranking based on NatureServe. Ranks have the following meaning: X = presume extirpated; H = historical (species) / possibly extirpated (communities); 1 = critically imperilled; 2 = imperilled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = not ranked; U = unrankable.

WSP conducted a fish survey of the Latoria Creek watershed in 2019 and 2020. A total of 179 three-spine stickleback were captured during minnow trap efforts and a total of 26 fish comprised of 19 three-spine stickleback, 4 coastal cutthroat trout and 3 prickly sculpin were captured during electrofishing. Three-spine stickleback represented the overall dominant fish species captured. No cutthroat trout or prickly sculpin were captured upstream of the Duke Road culvert in Spruston Creek (fish site ID 6) or upstream of the waterfall in Latoria Creek below the residential pond, south-east of Duke Road (fish site ID 15b). As part of the fish survey eight baited minnow traps were set for 48 hours in April 2021, in the large wetland located to the south of the Site (FP-11). A second effort was made in December 2021 (2 traps for 24 hours). No fish were captured, although several predacious water beetles and a rough-skinned newt (*Taricha granulosa*) were caught. Red-legged frog (*Rana aurora*) and Pacific tree frog (*Pseudacris regilla*) are also known to occur in the watershed.

## *2. Results of Detailed Riparian Assessment*

Date: September 23, 2024

Description of Water bodies involved (number, type): 1 wetland

| | |
|---|---|
| Stream | |
| Wetland | 1 |
| Lake | |
| Ditch | |
| Number of reaches | 1 |
| Reach # | 1 |

**Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)**

| | Channel Width(m) | Gradient (%) |
|---|---|---|
| starting point | | |
| upstream | | |
| | | |
| | | |
| | | |
| downstream | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Total: minus high /low | | |
| mean | | |

| | R/P | C/P | S/P |
|---|---|---|---|
| Channel Type | | | |

I, Susan Blundell ), hereby certify that:

a) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Fish Protection Act*;

b) I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd. ;

c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and

d) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation.

**Site Potential Vegetation Type (SPVT)**

| | Yes | No | |
|---|---|---|---|
| SPVT Polygons | | x | Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes |

I, Susan Blundell , hereby certify that:

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| | | LC | SH | TR | Method employed if other than TR |
|---|---|---|---|---|---|
| Polygon No: | 1 | | | | |
| SPVT Type | | | | x | |
| Polygon No: | | | | | |
| SPVT Type | | | | | |
| Polygon No: | | | | | |

| SPVT Type | | | | |
|---|---|---|---|---|

## Zone of Sensitivity (ZOS) and resultant SPEA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | 1 | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | 15 | | | | | | | |
| Litter fall and insect drop ZOS (m) | 15 | | | | | | | |
| Shade ZOS (m) max | 30 | South bank | Yes | | No | X | | |
| Ditch | Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow) | | | | | | | |
| Ditch Fish Bearing | Yes | | No | | If non-fish bearing insert no fish bearing status report | | | |
| **SPEA maximum** | **30** | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

I, Susan Blundell, hereby certify that:

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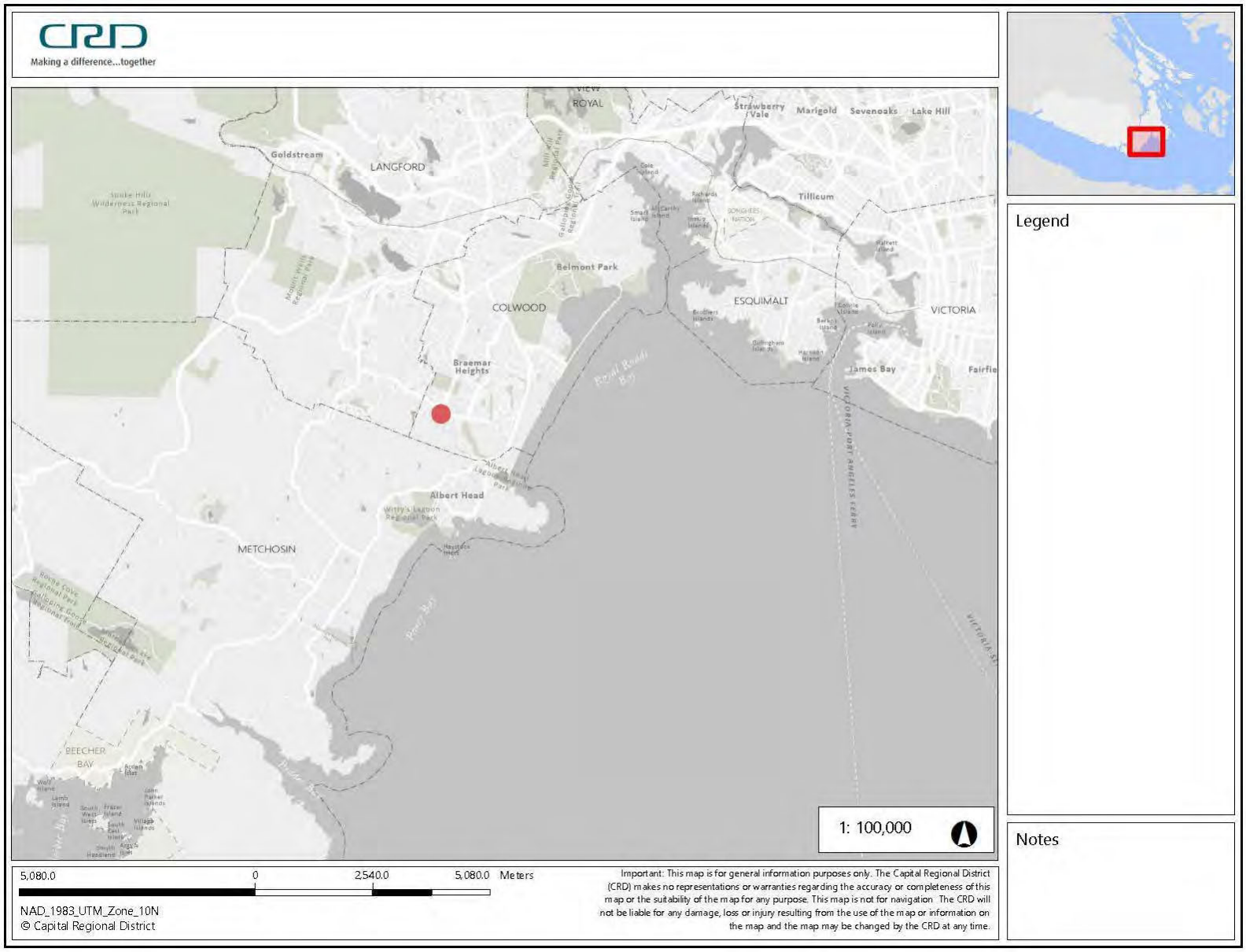
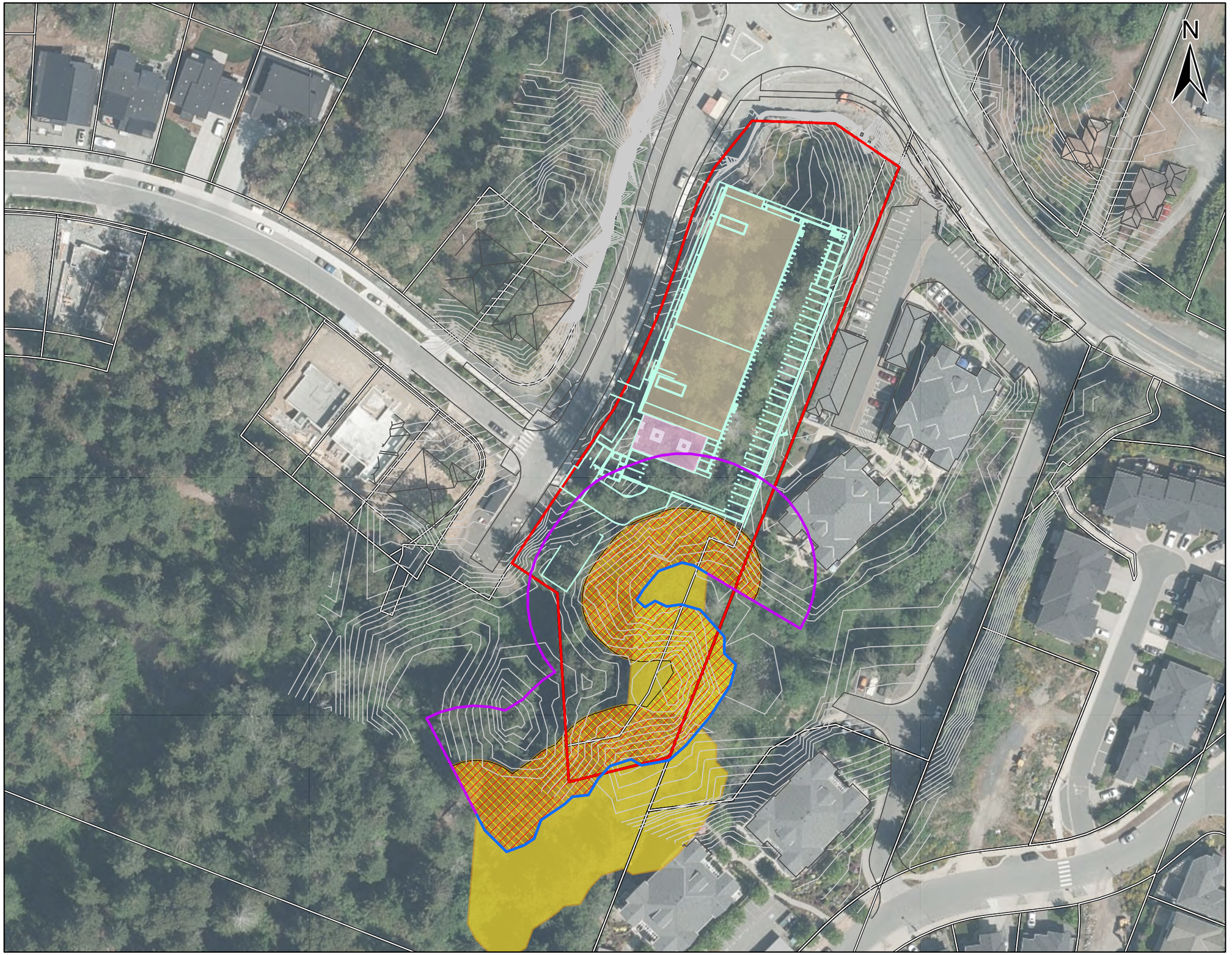
c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and

d) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation.

## *Comments*




| | | | | | |
|---|---|---|---|---|---|
| wsp | PROJECT: | 3601 OLYMPIAN WAY | | | |
| | TITLE: | PROJECT LOCATION | | | |
| | CLIENT: | WESTURBAN DEVELOPMENTS LTD. | | | |
| FIGURE NO.: 1 | DATE: OCT 2024 | FILE NO.: CA0035496.7539 | SCALE: NTS | DRAWN BY: SB | REV NO.: |




LEGEND

- HIGH WATER MARK
- CONTOUR
- PARCEL BOUNDARY
- ZOS LEAF LITTER/INSECT DROP
- ZOS LWD (LARGE LITTLE DEBRIS)
- ZOS ASSESSMENT SHADE
- SPEA
- RIPARIAN ASSESSMENT
- DESIGN LINE
- DESIGN BUILDING
- DESIGN DECK
- PROJECT BOUNDARY

0 5 10 20 30 40 50
1:1,000 Meters

REFERENCES

1. Parcel and hydrography data contain information licensed under the Open Government License – British Columbia
Spatial Reference: NAD 1983 UTM Zone 10N

CLIENT
WEST URBAN DEVELOPMENT LTD.

PROJECT
3601 OLYMPIAN WAY, COLWOOD, BC

TITLE
RIPARIAN ASSESSMENT

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-10-15 |
| DESIGNED | SB |
| PREPARED | MY |
| REVIEWED | |
| APPROVED | |

| PROJECT NO. | CONTROL. | REV. | FIGURE |
|---|---|---|---|
| CA0035496.7539 | | A | 2 |

W:\Client\WestUrban Development Ltd\Colwood\99 PROJECTS\CA0035496 7539\02 PRODUCTION\MXD\Report\REV A 3601 Olympian Way Riparian Assessment 2024 0925 YZW copy.aprx

## *Section 4. Measures to Protect and Maintain the SPEA*

| | |
|---|---|
| 1. Danger Trees | Details are presented in the attached windthrow and hazard tree assessment report. |
| I, Margaret Symon, hereby certify that:<br>e) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act* ;<br>f) I am qualified to carry out this part of the assessment of the development proposal made by the developer; WestUrban Developments Ltd. ;<br>g) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| 2. Windthrow | The windthrow hazard associated with the wetland SPEA at Lot 35 Olympian Way is assessed as MODERATE (to somewhat HIGH). The structure and composition of the somewhat multi-storied, somewhat mixed canopy within the riparian setback area contributes to a fairly resilient windfirm stand. Minor to moderate evidence of historical (and recent) windthrow was observed. Increased risk of blowdown is related to trees with shallower rooting systems in imperfectly drained soils along the wetland edge. During winter storms, rooting systems in wetter soils could become unstable; high winds can rock these trees, increasing potential for blowdown. Strategies to reduce potential windthrow should focus on minimizing disturbance to root systems and rehabilitating any degraded riparian habitat. Measures to prevent windthrow should follow standard practices to minimize disturbance to rooting layers during land clearing and residential construction. Inputs of coarse woody debris to the forest floor along setback perimeters will improve soil function, structure and productivity, and will increase opportunities for small animal species. The SPEA setback for the wetland on Site (15 m north, west and east, 30 m south) is adequate for windthrow and hazard tree management, conditional on all recommendations being met as outlined in the attached Windthrow and Hazard Tree assessment report. Further details are presented in the attached windthrow and hazard tree assessment report. |
| I, Margaret Symon, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer; WestUrban Developments Ltd. ;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| d. Slope Stability | Based on the review of available quaternary soils mapping of the area, the soil conditions are expected to generally consist of a thin layer of glacial till comprised of a variable mixture of gravel/sand/silt/clay, atop shallow bedrock. Based on the site reconnaissance, the presence of shallow bedrock was confirmed. Soil cover was generally shallow, and several bedrock outcroppings were observed within the center of the property. On the basis of the desktop study and site observations, the proposed |

| | |
|---|---|
| | development is considered to be geotechnically feasible, and unique geotechnical issues during construction are not anticipated. The development of the Site will not result in any slope stability issues and will not pose any risk to the integrity of the SPEA. Further details are presented in the attached geotechnical report. |
| I, Austin Baird, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer ; WestUrban Developments Ltd.<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| e. Protection of Trees | Trees within the SPEA will be protected during site clearing and construction with a physical barrier, such as snow fencing, which will prevent mechanical damage to trees. For trees occurring along the SPEA boundary, allowances will be made to extend the tree protection zone to encompass the tree's Protected Root Zone (PRZ, equal to radius of 18 x Diameter at Breast Height) through to completion of construction. |
| I, Susan Blundell, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd. ;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| d. Encroachment | A split rail fence will be constructed along the entire SPEA boundary to delineate the area so that no trees or understorey vegetation is removed or damaged, or structures are built within the zone. |
| I, Susan Blundell, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd. ;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| e. Sediment and Erosion Control | Prior to, and during construction, some or all of the following measures will be used to minimize the sediment leaving the site and entering the adjacent wetland:<br>• Areas stripped will be limited to the proposed layout boundaries, with all equipment traffic confined to the right-of-way area, except where additional work is required. Existing vegetation will be retained or replanted, where practical.<br>• Stormwater runoff shall be directed away from stripped areas through the use of by-pass swales/ditches. Temporary conveyance ditches will be constructed to reduce the likelihood of wash-out by using check dams, filter cloth, sandbags, riprap, etc.<br>• Steeply sloped areas will be stabilized or terraced; plastic sheeting or cocoa-matting can be employed to reduce erosion. |

| | |
|---|---|
| | • To reduce the tracking of mud offsite, rock pads and/or a wheel wash station may be constructed at site access points.<br>• Where practical, settling ponds with a controlled outlet and emergency overflow may be used to improve stormwater quality. Pond sizing and settlement time will be determined by the project engineer.<br>• Re-vegetating areas of exposed soil will take place as soon as possible. Hydro-seeding, filter cloth, cocoa-matting and other geo-grids may be employed to aid growth.<br>• Existing and newly installed catch basins will be equipped with silt sacks to control sedimentation.<br>• Stockpiles of topsoil will be tarped and/or surrounded by sediment fencing and where possible seeded with grass seed (non-invasive species) to ensure that silt-laden runoff does not enter the wetland.<br>• Contractor is to retain a stockpile of siltation control measures onsite at all times. These include straw bales, silt fencing, drainage rock, and tarps<br>• Early and continued implementation of siltation control measures will be monitored with recommendations given to contractor regarding placement and suitability.<br>• All works will stop in the event of a stormwater breach which results in sedimentation of adjacent waterbodies/watercourses. The stormwater breach will be contained and acceptable clean-up measures will be undertaken. |
| I, Susan Blundell, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act;*<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd.;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| d. Stormwater Management | Based on CRD GIS mapping, the site slopes downwards towards the southeast to a wetland located on the property immediately adjacent to the site, 595 Latoria Road. The CRD GIS shows the wetland discharging to North Latoria Creek. Due to the immediate receiving environment being a fish bearing creek (Latoria Creek) the release rate from the development will be set at the predevelopment peak 2-year storm, considered to be the channel forming event, with the remaining volume of runoff being detained onsite. Treatment of runoff from the roof will be required for total suspended solids (TSS), and from the parking lot for TSS, hydrocarbons, and 6PPD-quinone. Detention is to occur within underground chambers, such as StormTech arch chambers or Graff EcoBlock chambers. The detention volume will be the difference between the predevelopment 2-year peak runoff rate and the various post development runoff rates. It is recommended to sheet flow the parking areas to the sunken planters in which the runoff will be allowed to accumulate to a 100 – 150mm depth. By directing runoff |

| | |
|---|---|
| | to the planters, the parking lot runoff will be treated for TSS, 6PPD-quinone, and hydrocarbons. Drainage within the site drain will be directed to the flow control manhole which will restrict runoff from the site to the 2-year pre-development runoff rate, as described previously. Runoff rates that exceed the release rate will be directed to the detention system and then slowly release over time. A high flow bypass will be provided for runoff events that exceed the capacity of the designed system. Water will then be directed through an oil grit separator before being released off-site. Please see attached report for further details |
| I, Bruce Crawshaw, hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd.;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |
| e. Floodplain Concerns (highly mobile channel) | There are no floodplain concerns as the adjacent wetland is not highly mobile. |
| I, Susan Blundell, hereby certify that:<br>f. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>g. I am qualified to carry out this part of the assessment of the development proposal made by the developer WestUrban Developments Ltd.;<br>h. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Schedule to the Riparian Areas Protection Regulation | |

Strathcona Forestry Consulting




# Windthrow & Hazard Tree Assessment

## Lot 35, 3601 Olympian Way, City of Colwood

*Prepared for*: WestUrban Developments Ltd.
Attn: Frank Limshue
E: flimshue@#westurban.ca

*Prepared by*: Strathcona Forestry Consulting
PO Box 387 Stn Mn
Duncan BC V9L 3X5
E: strathcona.fc@shaw.ca

2 Sept. 2024

# Executive Summary

In accordance with the Riparian Areas Protection Regulation (RAPR), WestUrban Developments Ltd. retained Strathcona Forestry Consulting to conduct a preliminary windthrow and hazard tree assessment of the wetland riparian setback area at 3601 Olympian Way (Lot 35), which is proposed for multi-family residential development. The Riparian Areas Protection Regulation (RAPR) assessment prepared by WSP of a wetland at the site identified a Streamside Protection Enhancement Area (SPEA) determined by three Zones of Sensitivity (ZOS). The forest stand at the riparian (wetland) setback provides habitat for a variety of mammals, birds, and herpetofauna, and enhances the aesthetic appeal of the area.

The purpose of this study was to determine any initial safety concerns associated with forest cover at the riparian setback, and to prescribe appropriate mitigation. This report discusses potential windthrow hazard, and also outlines measures to protect and/or enhance riparian tree cover in conjunction with proposed development of Lot 35.

The assessment determined the windthrow hazard is generally moderate (to somewhat high when soils become saturated in winter). The mixed canopy, multi-structured stand structure affords relative stability to the forested riparian habitat. Several live and dead standing snags were observed; these trees do not currently pose a threat; however, prior to commencement of construction activities, a tree survey should be undertaken to determine if any trees have become hazardous as a result of a change in conditions since the time of this initial assessment.

Protection measures for trees in the riparian setback will improve the health and vigour of the forest ecosystem, and will also improve safety and enjoyment for future property owners. Specific care must be taken to minimize disturbance of the rooting zones of trees along the forested perimeter of the wetland.

Strategies outlined in this report to manage trees and enhance biodiversity at the subject proposal were prepared in liaison with WSP, and align with objectives to enhance the forested riparian environment at development sites at the City of Colwood.

## Introduction

In accordance with the Riparian Areas Protection Regulation (RAPR), WestUrban Developments Ltd. retained Strathcona Forestry Consulting to conduct a preliminary windthrow /hazard tree assessment of the riparian (wetland) forest setback at 3601 Olympian Way (Lot 35), which is proposed for multi-family residential development.

The purpose of this report is to determine whether there are initial windthrow safety concerns associated with tree cover interfacing proposed residential development, and, where necessary, to prescribe appropriate mitigation. This report describes forest cover and conditions at the site, and also reviews the results of the windthrow hazard assessment. This report, prepared in liaison with WSP, comments on habitat values, and offers strategies to enhance local biodiversity in alignment with objectives to protect and enhance forest ecosystems and biological diversity at development sites at the City of Colwood.

## Field Assessment

Field work took place between June and August 2024. Potential windthrow was assessed through inspection of a range of biophysical site factors, including slope, aspect, rooting depth, coarse fragment content, ground and surface vegetation, drainage, canopy composition and layering, stand age and condition. Forest stands were inspected for evidence of historical blowdown. Observations of potentially hazardous trees included species, height, diameter, stability, defects, and level of disturbance. A survey of wildlife trees - individual trees that provide shelter, space, food or water for wildlife – examined tree species, classes, and condition.

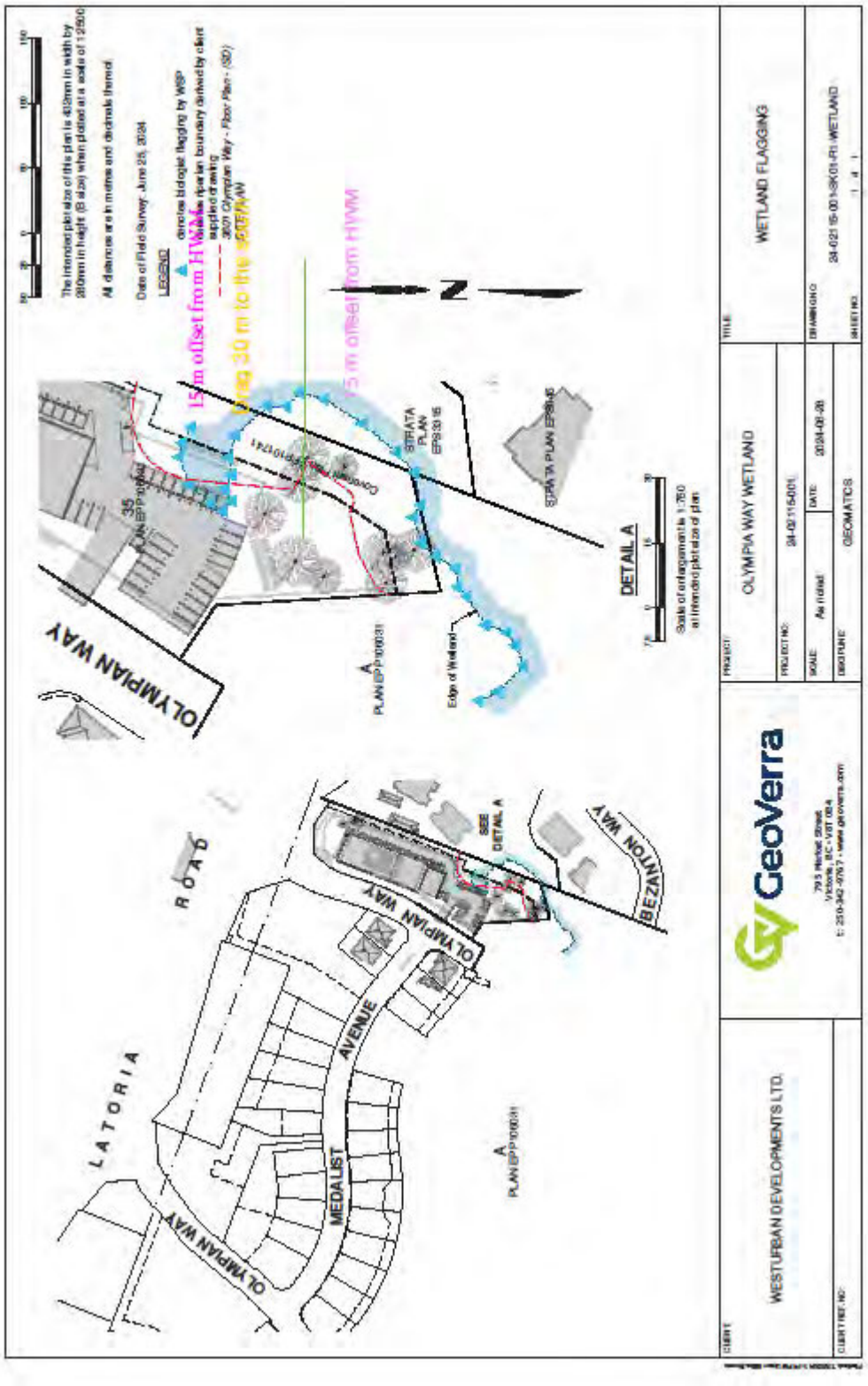
## Location and Description of Proposed Development

Multi-family residential development, including a parking area, is planned at Lot 35 on the east side of Olympian Way, south of Latoria Road (see Concept Plan below). An Environmentally Sensitive buffer area is located along the eastern boundary of the proposal. A wetland borders a portion of the southeastern precincts of the property (see Wetland map, next pg.).

***Concept Plan: 3601 Olympian Way (WestUrban Developments Ltd.)***




***Next pg: Wetland mapping (WSP)***


WETLAND FLAGGING
OLYMPIA WAY WETLAND
GEOMATICS
GeoVerra
WESTURBAN DEVELOPMENTS LTD.
DETAIL A
OLYMPIAN WAY
LATORIA ROAD
MEDALIST AVENUE
BEZANTON WAY
STRATA PLAN EPS3315
Edge of Wetland
15 m offset from HWM
15 m offset from HWM







***Top: Environmentally Sensitive Area on eastern boundary of subject proposal; middle: view looking east at wetland forest from Olympian Way; bottom: view looking southeast at Olympian Way from Latoria Road.***

## Riparian Areas

The Riparian Areas Protection Regulation (RAPR) was enacted under Section 12 of the Fish Protection Act in July 2004. The Fish Protection Act was subsequently re-titled the Riparian Areas Protection Act in February 2016. The RAPR calls on local governments to protect riparian areas during residential, commercial, and industrial development by ensuring that a Qualified Environmental Professional (QEP) conducts a science-based assessment of proposed activities. The intent of the regulation is to protect the natural environment, riparian ecosystems, and biological diversity.

Riparian zones with areas of land and vegetation adjacent to streams provide a range of important functions, including fish and wildlife habitat, erosion, flood protection, sedimentation control, and stream bank stability. Riparian areas need to remain in a largely undisturbed state to provide these functions.

Riparian assessment conducted by WSP determined the SPEA of the wetland at Lot 35 is determined by three Zones of Sensitivity (ZOS):

Large woody debris and Bank Stability – 15 m from HWM (offset)

Litter Fall and Insect Drop – 15 m from HWM (offset)

Shade – 30 m from HWM (dragged directly south)

## General Description

Situated in the Georgia Lowlands (eastern, leeward side of south-central Vancouver Island, between the Vancouver Island Mountain Range and the Salish Sea), the subject proposal occupies a gently to moderately sloping gradient with a variable aspect. Classified in the Coastal Douglas-fir moist maritime Biogeoclimatic subzone (CDFmm), with the most moderate climate in Canada, winters are mild and moist, while summers are warm and relatively dry, and often are characterized by prolonged droughts.

Tree cover surrounding the wetland is comprised of a mature, mixed forest stand dominated by coniferous trees (Douglas-fir [*Pseudotsuga menziesii*] and western redcedar [*Thuja plicata*]), together with deciduous trees (red alder [*Alnus rubra*], bigleaf maple [*Acer macrophylla*], bitter cherry [*Prunus emarginata*], and minor black cottonwood [*Populus trichocarpa*]. Top dieback and "flagging" (indicative of compromised tree health – likely related to recent summers with prolonged drought periods) were observed at a number of western redcedar trees. A small number of standing dead red alder trees were noted. Both coniferous and deciduous live and dead trees contained woodpecker feeding (and some nesting) cavities. Several species of passerine birds were heard.

The discontinuous to somewhat continuous understorey along the perimeter of the wetland forest setback is comprised of a shrub layer of salal (*Gaultheria shallon*), sword fern (*Polysticum munitum*), snowberry (*Symphoricarpus alba*), and baldhip rose [*Rosa gymnocarpa*]. Within closer proximity to the wetland there are a number of hydrophilic shrubs: e.g., sweet gale (*Myrica gale*).

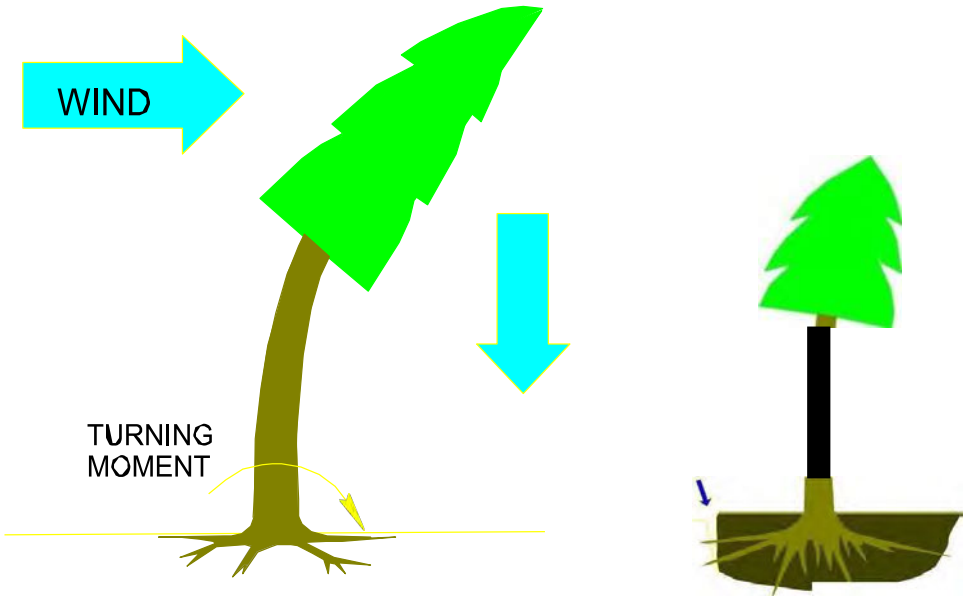
Infestations of invasive weed species were observed at localized locations around the wetland fringes: Himalayan blackberry – *Rubus armeniacus*, Thistle species – Cirsium spp., Daphne (Spurge-laurel) – *Daphne laureola,* Scotch broom – *Cytisus scoparius,* Queen Anne lace – *Daucus carota,* and trailing blackberry *(Rubus ursinus)*.

## Windthrow – Background Information

> Windthrow (Tree fall) – tree uprooting or stem breakage that results when wind loads exceed stem or anchorage strength.

The purpose of windthrow assessment is to determine whether there are windthrow concerns with tree cover within the wetland SPEA, and to prescribe appropriate mitigation.

In coastal BC, the most common cause of stand damaging winds is the western movement of extra-tropical low pressure systems from the Pacific Ocean. These storms produce counter-clockwise rotating regional-scale wind fields that interact with local geography and terrain. Pacific low pressure systems are strongest during the coolest months (i.e. October to April) when they are accompanied by gusty winds and high rainfall. The long duration of these storms and the high rainfall can be significant factors in windthrow risk because root-soil cohesion breaks down as trees rock back and forth in wet soil. In routine events, local geography and terrain produce predictable differences in local wind speeds. Catastrophic damage patterns during intense systems are less dependent on local terrain.




During strong Pacific low systems with wind and heavy rains, root-soil cohesion breaks down as trees rock back and forth in wet soil (left). Intense winds can cause boles to “snap” (right).

The other large scale weather systems which can cause stand damaging winds are arctic ridges of high pressure. These cold, dry systems occasionally move south over the interior of BC and outward toward the coast. Strong outflow winds through major valleys are associated with these winter systems, particularly when there is an offshore low pressure system and therefore a steep differential gradient in surface air pressure (high to low).

In the summer, local wind effects are created where strong differences in air temperature develop. On-shore winds develop in the afternoon as the land heats up relative to the ocean.

**Windthrow Assessment**

Windthrow hazard and likelihood assessment is conducted on forest stands that have a risk to values or objectives as a result of windthrow.

1. A set of diagnostic questions is used to assess various hazards for windthrow.

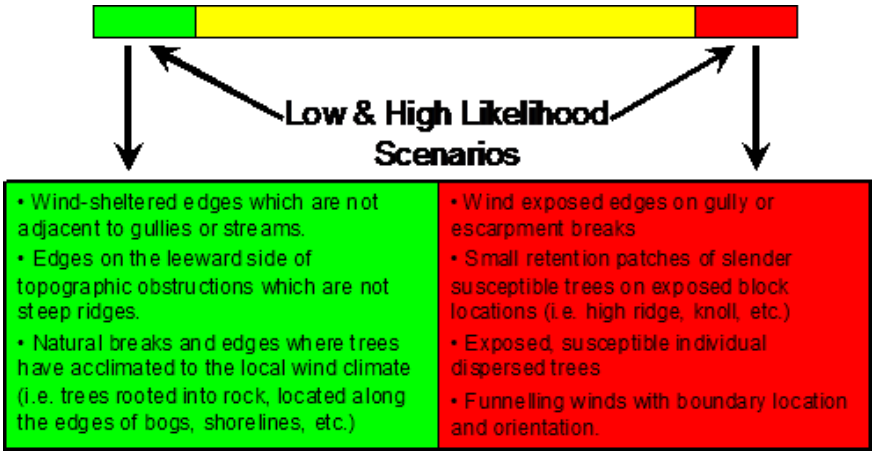
2. Three hazard components (topographic, stand and soil) are assessed and then brought together in a ranking table to provide an overall biophysical hazard for windthrow. The three components take into account location, and characteristics of the stand and soil median - all factors critical to assess the inherent hazard of the area for windthrow – i.e., the biophysical hazard.

Biophysical Hazard – the intrinsic stability of the stand in its pre-treatment condition. The inherent ability to resist wind damage is the cumulative result of topographic, soils and stand features interacting as the stand develops with endemic windloading.

3. The biophysical hazard is then used along with an estimate of treatment hazard (activity associated with development) to rank the likelihood of windthrow occurring on the edge segment.

Treatment Hazard – is the way in which a particular treatment increases or decreases the windloading or wind resistance of trees. A simple example of treatment hazard is the influence of land clearing to expose new edges. Treatment hazard can be reduced by further treatments such as pruning, or topping.

Treatment hazard ranges from low to high depending on how or where land clearing will be applied. The two working together give an indication of how likely windthrow will be on the edge or within a retained forest stand, (i.e., the likelihood of windthrow).




4. Once the likelihood of windthrow is determined, consequences are considered to provide an assessment of windthrow risk. Windthrow risk is the combination of the likelihood of windthrow and the potential consequences of that windthrow. Windthrow risk reflects the risk associated with the site plan, considering the likelihood of windthrow against limits (thresholds) that are set based on consequences.

Windthrow risk is not equal to the likelihood of windthrow. If considerable windthrow is expected, but there are no consequences, there is little risk.

**Windthrow impact definitions**

• *Windthrow Likelihood* - is the expected level of damage from endemic winds. It combines Biophysical Hazard and Treatment Hazard.

• *Windthrow Consequences* - is the probable level of impact on specific management objectives, or sensitivity of those objectives, if the expected level of windthrow occurs.

• *Windthrow Risk* - is the potential for a negative consequence from windthrow caused by endemic winds. It is the combination of Windthrow Likelihood and Consequence.

Windthrow treatment, when prescribed, is necessary to retain and/or enhance riparian habitat and reduce hazard (to workers, residents, visitors, structures).

## FIELD ASSESSMENT - WINDTHROW

Due to previously disturbance from human activities at the subject proposal, the riparian (wetland) stand was assessed as one edge segment:

1. **Edge segment: Wetland stand at Lot 35**

**Wind force Indicators:**

**Biophysical Hazard -**

**Topographic Exposure:** Is this a windy area?
*Moderately windy area. The proposal is located in a somewhat sheltered area buffered by rolling topography to the south and west.*
**Topographic Hazard Class:** Moderate (Moderate Exposure)
**Stand stability:** Are trees acclimated to wind loading?
*Adjacent areas were logged in recent years in conjunction with development. Edge trees appear somewhat to moderately acclimated to wind loading. The wetland stand is a moderately open, multi-canopied, mixed stand with a number of gaps. There is minor evidence of historical/ recent blowdown as indicated by occasional downed trees (both deciduous and coniferous). Higher water table in winter may predispose more shallowly rooted trees rimming the wetland to blowdown during very heavy windstorms.*
*Several western redcedars have dead tops / flagging, and over time, may be weakened by a succession of winter storms and summer droughts, and could be subject to blowdown.*
*Some standing dead red alder trees.*
**Tree-level indicators of acclimation:** *Multi-aged*, u*neven canopy.*
**Stand Hazard Class:** *Moderate (neutral)*
**Soil Anchorage**: Is root anchoring restricted by an impeding layer, low strength soil, or poor drainage? Is this a closed-canopied stand? Is there evidence of blowdown?
*Soils in the general area generally have strong soil strength (moderate to higher CFC). Moderate rooting. Soils around the wetland are imperfectly drained (reduced stability). As noted above, shallowly rooted trees can be susceptible to blowdown during strong storms in fall and winter when soils are saturated.*
**Soil Hazard Class:** *Moderate*
**Hazard:** Have prolonged summer droughts (2022, 2023, 2024) substantially increased wind loading on trees along the stand edge (or within riparian stand)?
*Prolonged summer droughts in recent years have likely weakened secondary rooting systems of trees on Vancouver Island. Strong winds and heavy winter rains have potential to weaken rooting systems of more shallowly rooted trees and any trees compromised by drought and other health issues.*

**Treatment Hazard Class:** Moderate (to somewhat High – when soils are saturated)

| WINDTHROW LIKELIHOOD EVALUATION: | | | | | | |
|---|---|---|---|---|---|---|
| **Biophysical Hazard = Topographic, Stand and Soil Hazards**<br>**Windthrow Likelihood = Biophysical Hazard + Treatment Hazard**<br>**If Treatment Risk is 'None,' then Windthrow Likelihood is 'None.'** | | | | | | |
| | **Very High** | **High** | **Moderate** | **Low** | **Very Low** | **None** |
| Topographic Hazard | | 3 | 2 | 1 | - | - |
| Stand Hazard | | 3 | 2 | 1 | - | - |
| Soil Hazard | | 2 | 1 | 0 | - | - |
| **Biophysical Hazard** | 8 | 6-7 | 4-5 | <4 | - | - |
| Treatment Hazard | | 6 | 4 | 2 | - | |
| **Windthrow Likelihood** | 14 | 12-13 | **10-11** | 6-9 | <6 | |

**Windthrow Risk Category**

What will be the consequences for safety and liabilities?

| | |
|---|---|
| VERY HIGH – very negative consequences | HIGH – negative consequences |
| MODERATE – slightly negative consequences | LOW – minimal to no consequences |

| **LIKELIHOOD of EXCEEDING WINDTHROW THRESHOLDS:** |
|---|
| **Likelihood categories** |
| **Nil –** Both assessed likelihood for penetration and amount are not close to thresholds |
| Low – Assessed likelihood does not exceed either thresholds buy may be close |
| **Mod –** Assessed likelihood somewhat exceeds amount threshold, but does not seem to exceed penetration threshold (where applicable) |
| High – Assessed likelihood considerably exceeds amount threshold, and/or seems to exceed penetration thresholds by a small amount (if applicable) |
| **Very High –** Assessed likelihood considerably exceeds penetration threshold, as well as amount threshold (if both apply) |
| Estimate likelihood of exceeding windthrow thresholds: Low-Mod |

| **WINDTHROW RISK ASSESSMENT** | | | | |
|---|---|---|---|---|
| **DIAGNOSTIC QUESTION:** If the thresholds for windthrow are exceeded as expected, what will be the consequences for development values, safety, liabilities and riparian management concerns? | | | | |
| Risk = | ☐ Very High (very negative) | ☐ ✓ High (Negative) | ☐ ✓ Moderate (slightly negative) | ☐ Low (minimal to no consequences) |

Generally, Very High, or High risk situations must be addressed to lower risk. A Moderate risk situation may also need to be addressed with mitigation measures, depending on consequences.

**Potentially Hazardous Trees:** Assessment of potentially hazardous trees at the site determined a small component of both coniferous (western redcedar, Douglas-fir, grand fir, and western hemlock) and deciduous trees (some red alder) at the riparian setback area may be prone to windthrow due to currently compromised health (obvious dead and/or dying stems, and/or reduced vigour attributable to various causes: summer droughts in recent years, disturbance of rooting zones by land activities), and could constitute safety issues in the future; at the present time, without an immediate target, these trees can be considered safe. Several standing dead snags currently do not pose a safety hazard (no defined target); any potentially hazardous trees will need to be inspected prior to startup of development.

Accordingly, prior to commencement of construction, a hazard tree assessment will need to be conducted to identify any hazardous trees that may have resulted from conditions (natural and/or manmade) occurring after this assessment took place. Currently, potentially hazardous trees should be monitored.

Where safely possible, forest cover in the wetland setback should be retained to enhance riparian biodiversity.



***Forest cover in the wetland setback area is comprised of mixed forest, and includes several standing dead snags which currently do not pose a safety hazard.***

## BEST MANAGEMENT PRACTICES to MANAGE WINDTHROW RISK

| Treatment | Description | Recommended for Trees |
|---|---|---|
| Retain; No treatment | Essential to avoid disturbance to roots (drip zone) | Monitor forest stands at the site, especially western redcedar trees with dead tops, and standing dead Dr, Mb, and ACT. |
| Topping | Removal of upper crown and stem | Not probable |
| Top pruning | Removal of branches from the upper crown | No |
| Spiral pruning | Removal of branches throughout the crown | No |
| Edge feathering | Intended to mimic partial damage along edges. Vulnerable trees (i.e., slender trees, codoms, low live crown ratios) are harvested at the edge before (it is assumed) they will blow down | Not likely to be required; stand edges have generally had time to adjust to winds. Minor to moderate blowdown along edges. |
| Coppicing | Deciduous trees are cut to reduce height and branching; live stem is retained | May be required as a result of hazard tree survey recommended prior to commencement of work activities. Particularly relevant to Mb |
| Fell<br>High stumping and/or retention of CWD may be a consideration | Tree is determined to be a hazard, and requires falling. Where safe, consider high stumping to retain value for wildlife. Where not safe, consider retaining Coarse Woody Debris to enhance biodiversity | Evaluate on a tree by tree basis at the time of detailed Hazard Tree Assessment |

Tree codes:
Hw = western hemlock ACT = black cottonwood
Mb = broad leaf maple Bg = grand fir
Cw = western red cedar
Dr = red alder
Fd = Douglas-fir

## Windthrow Discussion

The windthrow hazard associated with the wetland SPEA at Lot 35 Olympian Way is assessed as MODERATE (to somewhat HIGH). The structure and composition of the somewhat multi-storied, somewhat mixed canopy within the riparian setback area contributes to a fairly resilient windfirm stand. Minor to moderate evidence of historical (and recent) windthrow was observed. Increased risk of blowdown is related to trees with shallower rooting systems in imperfectly drained soils along the wetland edge. During winter storms, rooting systems in wetter soils could become unstable; high winds can rock these trees, increasing potential for blowdown. Climate change (e.g., recent warm summers with prolonged droughts) is stressful to specific tree species (e.g., western redcedar), increasing susceptibility of these trees to winter storm events.

The wetland forest at Lot 35: 1) supports a moderately high diversity of wildlife and maintains key ecological processes; and 2) likely contributes to regulating local drainage. Several wildlife trees observed at the proposal provide habitat for cavity nesting birds and raptors, and bats. The varied edge effect provided by mixed tree and shrub layers supports a large number of passerine birds.

Strategies to reduce potential windthrow should focus on minimizing disturbance to root systems, and rehabilitating any degraded riparian habitat. Measures to prevent windthrow should follow standard practices to minimize disturbance to rooting layers during land clearing and residential construction. Inputs of coarse woody debris to the forest floor along setback perimeters will improve soil function, structure and productivity, and will increase opportunities for small animal species, such as salamanders and voles.

## Recommendations

- Prior to commencement of land clearing and construction, a certified danger tree assessor must be retained to conduct an ocular survey to identify any hazardous trees that may have resulted from conditions (natural and/or manmade) occurring after this assessment took place. Should any trees be designated as hazardous, appropriate mitigation must be done to abate the hazard.

- Identified Danger Trees should be treated prior to the bird nesting window for the region (no felling March 15- August 15).

- A qualified monitor (QERP) should oversee tree retention and protection activities at the project.

- Minimize disturbance to roots of trees within and on the edge of riparian setback area. Minimize ground disturbance within the drip line (**at least 2.5 m from perimeter trees)**.
  Tree protection barriers must be built to ensure trees are not damaged during construction. Barriers are required around any protected/retained trees that could be impacted by development.
  Materials: Install plastic mesh screening and stakes around retained trees; install a minimum distance of six (6) times the tree diameter.

- Permanent fencing (e.g., split cedar rail) is recommended to demarcate riparian forest setbacks post-construction. Fencing will prevent people from wandering into the stream area, which disturbs riparian habitat.

- Promptly re-vegetate any areas of soil disturbed by land clearing and construction with approved landscaping materials and/or native plant species. Re-vegetate areas of exposed soil with ecologically suitable native tree and shrub species of a size that will quickly re-establish cover when construction activities are deemed complete in order to minimize encroachment of invasive weed species (e.g. broom, Himalayan blackberry, English ivy, daphne, holly, thistles).

- Plan to remove localized thickets of invasive brush (e.g., Himalayan blackberry, Scotch broom) along perimeters of riparian forest setback. Consider rehabilitating with native shrubs and tree seedlings that will soon shade out invasive ingress.

- In liaison with WSP, under-plant ecologically suitable, native herbs and shrubs (e.g., twinberry, sword fern, red osier dogwood, dogwood, willows) along portions of the wetland forest stand where tree cover is reduced as a result of previous disturbances (see chart next pg.). Numbers of plantings will need to be calculated pending a post-clearing survey (RPBio/RFP). Suggested plantings could include:

| Plantings | Size | Spacing | Total Number*<br>* assess after land clearing |
|---|---|---|---|
| Twinberry (*Lonicera involucrata*) | 2 or 5 gal. pots | 1x1 m | TBD |
| Red osier dogwood (*Cornus stolonifera*) | 2 or 5 gal. pots | 1x1 m | TBD |
| Sword fern (*Polystichum munitum*) | 2 or 5 gal. pots | 1.5 x 1.5 m | TBD |
| Dogwood (*Cornus nutallii*) | 5 gal. pots | 2 x 2 m | TBD |

- Any hazard trees identified to be felled that have trunks > 40 cm dbh should be placed in forested buffer areas as CWD (coarse woody debris). Any coarse woody debris (CWD) added to reserve zone will constitute no more than 1 m of CWD per lineal m of setback boundary. Inputs of coarse woody debris to the forest floor along the perimeter of the setback area will improve soil function, structure and productivity, and will increase opportunities for small animal species, such as salamanders and voles.

- Discourage future property owners from damaging retained trees by not loading rock fill on roots, not storing garden equipment and vehicles along riparian setback areas, not tying ropes or wires around tree stems, and not hammering nails into trees.

If the recommendations contained in this report are implemented, risk associated with windthrow and potentially hazard trees can be mitigated to ensure the safety of the proposed residential development. Recommended strategies for tree protection were prepared in alignment with TerraWest to enhance forested ecosystems at development site at the City of Colwood.

LIMITATIONS

*This report provides an assessment of windthrow/danger tree hazard and risk. Evaluation is based on professional judgment. The investigation involved a field observation. Recommended treatment pertains only to the particular site as disclosed at the time of inspection. The report was prepared considering site-specific circumstances and conditions. It is intended only for use by the client for the purpose for which it was commissioned and for use by local government regulating the activities to which it pertains.*

Prepared by:

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June 27, 2024
File No: 8298-23

WestUrban Developments Ltd.
#21-3318 Oak Street
Victoria, British Columbia
V8X 1R1

Attn: Graeme O'Keefe (E[redacted])

Re: Proposed Multi-Family Development
3601 Olympian Way – Colwood, BC.

As requested, and in accordance with our accepted proposal of May 15, 2024, we have completed a geotechnical assessment of the referenced site. The following letter summarizes the results of our investigation and associated recommendations as related to the proposed development. Our work has been carried out in accordance with, and is subject to, the previously provided Terms of Engagement.

## PROPOSED DEVELOPMENT

The project site is currently undeveloped, moderately forested and is bounded by Latoria Road to the north, residential properties to the east, vacant land to the south, and Olympian Way to the west. Topographically, the site slopes down from north to south for total relief of approximately 13 m over a distance of approximately 150 m.

We understand the building design is within the preliminary stages, however, based on the feasibility drawings prepared by Union Architecture (attached to our report for reference), we understand that the proposed development would consist of the construction of a six-storey multi-family residential building. The building as proposed would be comprised of 90 units, with parking provided below the building at grade. We anticipate the building would consist of conventional reinforced concrete for the parking area and suspended/podium slab with timber frame above.

## INVESTIGATION PROCEDURE

Our geotechnical assessment consisted of a desktop study and a site reconnaissance. The desktop study included a review of our previously completed work in the area, as well as a review of available quaternary soil mapping, topographical mapping, water well data, and aerial/satellite imagery.

## SURFACE AND SUBSURFACE CONDITIONS

Based on our review of available quaternary soils mapping of the area, we expect the soil conditions generally consist of a thin layer of glacial till comprised of a variable mixture of gravel/sand/silt/clay, atop shallow bedrock.

Based on our site reconnaissance, we confirm the presence of shallow bedrock. During our attendance, we observed a bedrock cut, approximately 7 m in height located adjacent to the north and east property lines, inclined at approximately 0.25H:1V (Horizontal to Vertical). Soil cover was generally shallow, and several bedrock outcroppings were observed within the center of the property. The central area of the site is a moderately forested area sloping from northeast to southwest comprised of coniferous and deciduous trees. The south area of the site is comprised of vacant land with a environmentally sensitive area within the northeast corner of site.

Long term groundwater observations were not undertaken as part of our work at this site. The relatively impermeable nature of glacial till and bedrock presence at depth precludes free water conditions. However, perched groundwater table conditions may be experienced during and after periods of prolonged precipitation within overburden fills/organic soils overlying the glacial till and bedrock.

## GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

On the basis of our desktop study and site observations, we consider the proposed development to be geotechnically feasible, and do not anticipate any unique geotechnical issues during construction.

## EXCAVATION CONSIDERATIONS

Based on site topography and proposed road and utility elevations, we expect that temporary excavation cutslopes during construction may be on the order of 2.5 m. Given the soil conditions encountered, we expect cutslopes will be stable at the following configurations:

- 1.0 H : 1.0 V (Horizontal : Vertical) for topsoil/fills;
- 0.75H : 1.0V compact to dense brown silt and sand, trace gravel (Glacial Till);
- Near vertical for intact/fractured bedrock

Topsoil and fill soils should be pulled back from the excavations to eliminate any chance these materials from sloughing into the opening. Adjustments to the above may be required if variations of the soil conditions are observed. According to WorkSafeBC guidelines, excavations deeper than 1.2 m and steeper than 0.75H:1V must be inspected and approved by a qualified geotechnical professional prior to worker entry.

Considering the anticipated excavation depths and the observed shallow bedrock conditions, rock excavation may be required to achieve design grades, such as blasting.

Blasting operations will need to be conducted using controlled techniques to limit the intensity of the ground vibrations, in order to minimize/mitigate the potential for damage and/or adverse effects to adjacent buildings/infrastructure. Vibration monitoring should be completed to ensure that Peak Particle Velocities (PPV) are kept below damage threshold values relating to adjacent structures and infrastructure. It is probable that neighboring residents will raise concerns regarding vibrations, even if some are not structurally harmful, and a pre-blast analysis and survey is strongly recommended to later verify or alleviate such concerns. For preliminary review, we recommend PPV's are maintained below 50 mm/s as measured at property line. Completion of an assessment of surrounding structures is recommended prior to conducting the excavation/blasting works.

Areas of marginal rock stability will result from the vibrations induced by the blasting activities and removal of support by excavation of the rock. Although the contractor is ultimately responsible for construction safety, it is essential that procedures be in place to identify and rectify areas of potential instability at the earliest opportunity.

Bedrock cutslopes will need to be scaled thoroughly by an appropriately sized excavator following each blast and inspected by a qualified professional during removal of the rock and/or soon after to identify areas of potential instability. Where heavily fractured rock or unfavourable bedrock discontinuity orientations are encountered, it may be necessary to stabilize such by means such as shotcrete or rock bolts if vertical rock faces are required or there is no room to accommodate flatter cutslope geometry. We recommend carrying a contingency of roughly 10% of the overall excavation cost in the event rock stabilization measures are required.

## SEISMIC CONSIDERATIONS

Greater Victoria is situated in a region of very high seismicity. Considerable earthquake risk exists, stemming from our proximity to the Cascadia subduction zone and numerous more local faults in southwestern BC and northwestern Washington State.

We anticipate that building foundations will be placed atop intact bedrock or engineered fill atop such. As such, a reasonable shear wave velocity in the upper 30 m ($V_s^{30}$) should be between 760 and 1500 m/s. This corresponds to a Site Classification for Seismic Site Response of 'B', in accordance with the current BC Building Code. If greater than 3 m of soil is present between the footings and bedrock, Site Class of 'C' should be used. The reference Site Class 'C' values for a 2% probability of exceedance in 50-year event for the site can be found on the attached 2015 National Building Code Seismic Hazard Calculation sheet. We note that the BC Building Code will adopt updated seismic regulations in March 2025. Building/Development permits submitted after March 2025 should

consider the updated seismic design values which can be attained using the 2020 National Building code Seismic Hazard Calculator.

We note that Site Class 'A' might be feasible depending on the bedrock conditions. Confirmation of such would require completion of a Downhole Seismic Test, which would require installation of a PVC casing to 30 m depth using an ODEX drill rig. Further details regarding completion of a downhole seismic test can be provided upon request, including scope and pricing.

The National Research Council of Canada (NRCC) has recently released an updated National Building Code (NBCC 2020) which was adopted by the Province of British Columbia for the BC Building Code on March 8, 2024 (BCBC 2024). However, the seismic changes of the new code will not come into effect until March 2025 which will fully adopt the NBCC 2020 Division B – 4.1.8. Earthquake Loads and Effects Section. The Structural Commentaries, which accompanies the new code have not been released; however, we can comment on the preliminary information available to date.

The new building code has significantly changed the seismic hazard within Southern Vancouver Island. This is due to an updated 6th generation seismic hazard model for Canada, which has incorporated the Leech River Valley/Devils Mountain Fault, in addition to the updated seismic hazard stemming from the proximity to an active tectonic plate boundary (Cascadia Subduction Zone). The new code has increased seismic response by a minimum of 15 to 50% depending on the Site Classification (Site Class), building period and specific location.

## SETTLMENT CONSIDERATIONS

Provided adverse soils (i.e. topsoils/organics and fill) are removed from all building/foundation areas and roadways, we expect that settlement at this site will be minor, if any, and of minimal significance to the structural or geotechnical design.

## FOUNDATIONS CONSIDERATIONS

We expect that conventional shallow foundations will be used to support the proposed six-storey building. We anticipate the materials present at the design foundation elevation will include either dense glacial till or bedrock. We consider the native soils present at the site will be capable of providing long term stable support to the proposed structure, however all existing topsoil and fill materials must be removed prior to placing footings or before recovering design footing grade with engineered fill. Provided the footings bear directly on the above noted undisturbed native subgrade and/or approved engineered fill placed atop such, footings may be sized using the Serviceability and Ultimate Limit State bearing resistances provided in Table 1:

**Table 1: Limit State Bearing Resistances**

| Subgrade Soil | Limit State Design (LSD) | |
|---|---|---|
| | Strip Footing | Pad Footing |
| Clean intact bedrock | 2,000 kPa (ULS) | 2,400 kPa (ULS) |
| ≤ 1 m of compacted blast rock atop bedrock | 625 kPa (SLS)<br>935 kPa (ULS) | 750 kPa (SLS)<br>1125 kPa (ULS) |
| Native dense glacial till or compacted over-blast | 200 kPa (SLS)<br>300 kPa (ULS) | 240 kPa (SLS)<br>360 kPa (ULS) |

(*Higher bearing capacity may be available for bedrock pending location specific review)

LSD values use a geotechnical resistance factor of 0.5 as per the current Canadian Foundation Engineering Manual. The above values are provided for design, and all native soil in foundation areas will need to be inspected by the project geotechnical personnel to confirm the noted bearing resistances prior to placement of engineered fill or concrete for foundations. We recommend minimum footing widths of 400 mm and 600 mm for strip and pad footings, respectively. Any disturbance of subgrade soils during construction activity will need to be rectified. All foundation subgrade should be inspected and approved by a qualified geotechnical professional prior to placement of engineered fill or foundation concrete.

If Seismic Site Class 'A' is desired, all foundation elements must be poured directly atop bedrock. The bedrock must be cleaned of all loose rock fragments, soil, water, and sediment that may settle within the excavation.

For frost protection, the base of all footings should extend to a depth of at least 450 mm below adjacent finished grades to minimize the effects of seasonal frost; unless said footings are cast directly atop bedrock.

## ENGINEERED FILL

Engineered fill, where required, should be placed upon approved subgrade, and must consist of select, well-graded, free draining granular material. The engineered fill must be placed and compacted in suitably thin lifts under the supervision of a geotechnical professional to at least 95% of the Standard Proctor Maximum Dry Density (SPMDD) value, or judged equivalent. The recommended lift thickness is dependent on both the type of material and the method of compaction, and such must be confirmed before placement of fill. The engineered fill must have a footprint that extends horizontally beyond the footings a distance equal to the thickness of the engineered fill, in order to provide adequate splay for foundation loads unless suitable splay is present within approved native soils. In perimeter areas, it is inadvisable to have splay extend beyond the property lines.

## FOUNDATION DRAINAGE/PERMANENT DEWATERING

Conventional perimeter foundation drainage consisting of perforated drain pipe surrounded by free draining granular material containing low fines, tied into the recommended free draining backfill material is recommended. To prevent the migration of fine-grained soil particles into the drainage system, a layer of medium weight, non-woven geotextile should be placed between the clean drain rock around the perforated pipe and the granular backfill material. The geotextile should encompass the entire drain rock/drain pipe system.

Due to an expected high silt content and relatively impermeable nature of glacial till and shallow bedrock, we expect that inground dispersal trenches/rock pits discharging into the described soils will not be feasible.

## SLAB ON GRADE

We consider the use of a reinforced concrete grade supported slab to be feasible. We recommend that all loose and deleterious material be removed to depth of approved native subgrade and be replaced with well compacted select granular fill beneath the suspended slab. We recommend a minimum of 150 mm of free draining granular fill beneath the slab. All imported sub slab fills must be compacted to a minimum of 95% of the SPMDD value, or judged equivalent by a qualified geotechnical professional.

## PAVEMENT CONSIDERATIONS

In areas of light traffic, 75 mm of asphalt over 250 mm of 19 mm minus crushed rock containing low fines should be sufficient. It may be possible to go to a 50 mm of asphalt over 250 mm of crushed rock, as is typical for low volume roads, but such a structure will deteriorate quicker and may crack slightly more than the 75 mm.

For heavier traffic areas, we suggest 75 mm of asphalt over a minimum of 150 mm of 19 mm minus crushed rock above 150 mm of 75 mm minus crushed rock. Alternatively, 300 mm of 19 mm minus could be used provided it is low in fines for good water drainage.

We recommend installing concrete slabs where garbage and recycling trucks will service the development, and that transition areas be paved with 80 mm of asphalt.

Optimum water content of the replacement fill soils described above is critical to achieve good compaction. We suggest performing spot check in-situ density tests to ensure soils are suitably compacted below paved areas.

## CLOSURE

In summary, we consider the proposed development to be feasible from a geotechnical perspective.

We trust the preceding is suitable for your purposes at present. Please don't hesitate to contact our office if we can be of further assistance.

Sincerely,
Ryzuk Geotechnical
PTPN: 1002996

[redacted]

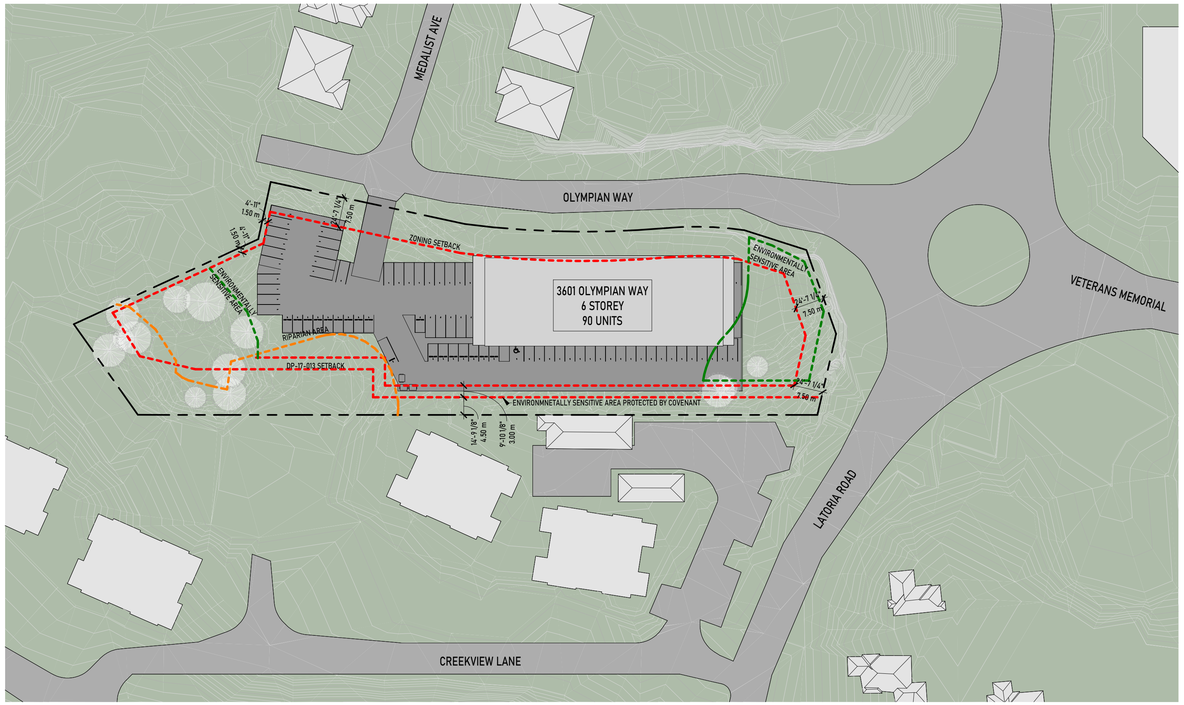
Alex Turner, B. Eng.
Junior Associate




[redacted]

Austin Baird, P.Eng.
Intermediate Geotechnical Engineer

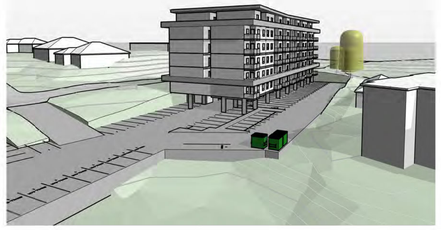
Attachments - Union Architecture Feasibility Drawings
- 2015 National Building Code Seismic Hazard Calculation



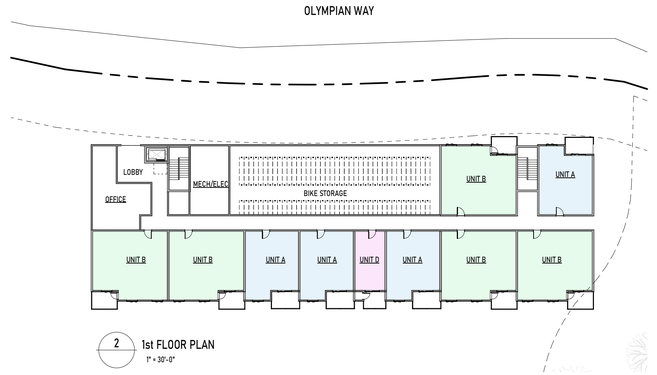

1 SITE PLAN
1" = 60'-0"



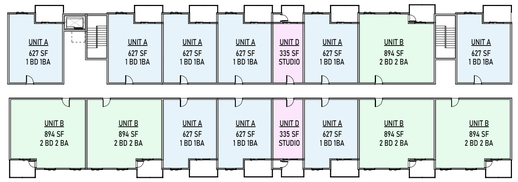
6 (SD) 3D Perspective 1



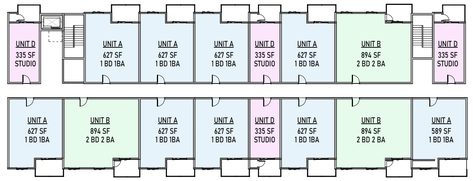
7 (SD) 3D Perspective 1 Copy 1



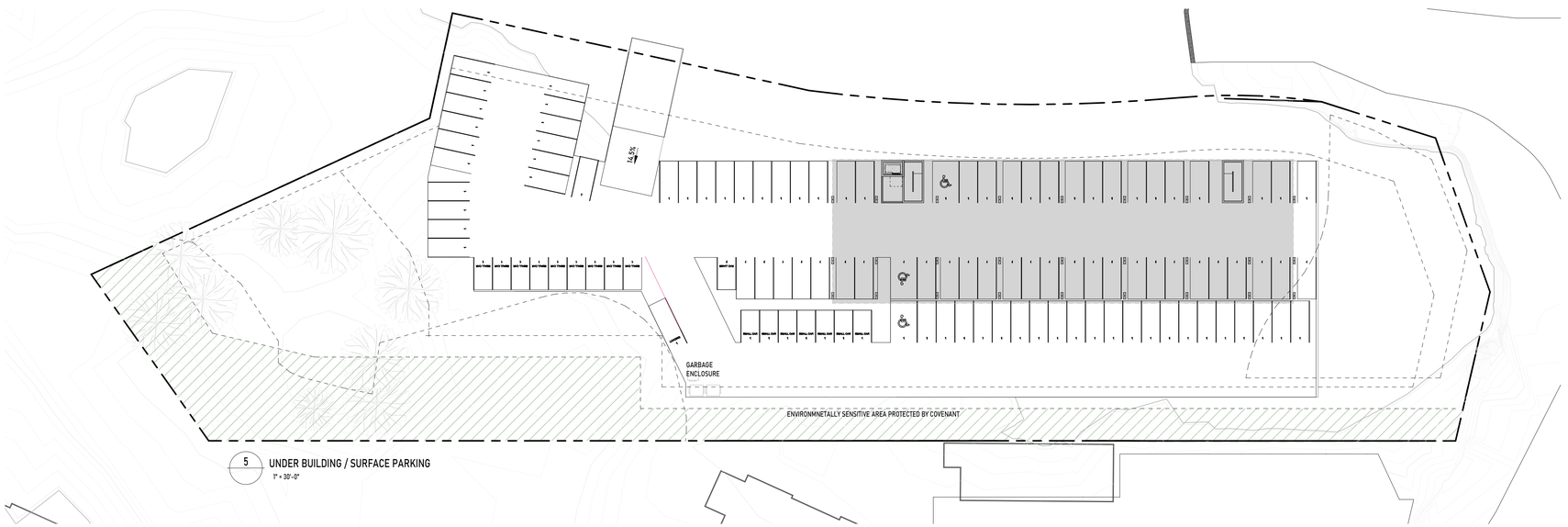

2 1st FLOOR PLAN
1" = 30'-0"




3 TYPICAL 2-5 FLOOR PLAN
1" = 30'-0"




4 6TH FLOOR PLAN
1" = 30'-0"




5 UNDER BUILDING / SURFACE PARKING
1" = 30'-0"

## PROJECT STATISTICS

**3601 OLYMPIAN WAY**

DATE 25-Apr-2024

| | | | | | | |
|---|---|---|---|---|---|---|
| **SITE INFORMATION** | | | | | | |
| CIVIC ADDRESS | 3601 OLYMPIAN WAY | | | | | |
| | EXISTING | | REQUIRED | | PROPOSED | |
| ZONING | XX | | XX | | XX | |
| SITE AREA | 8,570 m² | 92,246 SF | 8,570 m² | 92,246 SF | 8,570 m² | 92,246 SF |
| FLOOR AREA RATIO (FAR) | - | | X.XX | | 0.90 | |
| SITE COVERAGE | - | | 0.0% | | 15.0% | |
| BUILDING HEIGHT | | | 0.00 m (Max) | 0.00' (Max) | 6 STOREYS | |
| SETBACKS | FRONT (EAST) | | 0.00 m (Min) | 0.00' (Min) | 7.50 m | 24.61' |
| | REAR (WEST) | | 0.00 m (Min) | 0.00' (Min) | 7.50 m | 24.61' |
| | SIDE (NORTH) | | 0.00 m (Min) | 0.00' (Min) | 7.50 m | 24.61' |
| | SIDE (FLANKING OLYMPIAN WAY) | | 0.00 m (Min) | 0.00' (Min) | 6.00 m | 19.69' |
| | SIDE (SOUTH) | | 0.00 m (Min) | 0.00' (Min) | 1.50 m | 4.92' |

| | | | | | | |
|---|---|---|---|---|---|---|
| **BUILDING DATA** | | | | | | |
| MULTIFAMILY UNITS | DESCRIPTION | # OF UNITS | AREA | | TOTAL AREA | |
| UNIT A | 1BR+1BATH | 49 | 59 m² | 639 SF | 2,909 m² | 31,311 SF |
| UNIT B (Standard) | 2BR+2BATH | 28 | 85 m² | 912 SF | 2,372 m² | 25,536 SF |
| UNIT E | STUDIO | 13 | 29 m² | 309 SF | 373 m² | 4,017 SF |
| TOTALS | | 90 | | | 5,654 m² | 60,864 SF |
| FLOOR AREAS | | | GROSS | | NET | |
| PARKADE P1 | | | 0 m² | 0 SF | | |
| LEVEL 1 | | | 1,289 m² | 13,874 SF | | |
| LEVEL 2 | | | 1,289 m² | 13,874 SF | | |
| LEVEL 3 | | | 1,289 m² | 13,874 SF | | |
| LEVEL 4 | | | 1,289 m² | 13,874 SF | | |
| LEVEL 5 | | | 1,289 m² | 13,874 SF | | |
| LEVEL 6 | | | 1,289 m² | 13,874 SF | | |
| | | TOTAL | 7,734 m² | 83,244 SF | | |
| AMENITY SPACE | | | 0 m² | 0 SF | | |
| BUILDING FOOTPRINT AREA | | | 1,289 m² | 13,874 SF | | |

| | | | | |
|---|---|---|---|---|
| **PARKING DATA** | | | | |
| PARKING TYPE | | | REQUIRED | PROPOSED |
| RESIDENTIAL | *Parking Bylaw Reference* | | 95.8 | 96 |
| VISITOR | *Parking Bylaw Reference* | | 13.5 | 13 |
| TOTAL PARKING | | | 109.3 | 109 |
| LOADING STALLS | *Loading Bylaw Reference* | | 1 | 1 |
| BICYCLE PARKING | *Bicycle Parking Bylaw Reference* | | 120 | 120 |

# 2015 National Building Code Seismic Hazard Calculation

**INFORMATION:** Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

**Site:** 48.408N 123.509W

2024-06-27 20:40 UT

| Probability of exceedance per annum | 0.000404 | 0.001 | 0.0021 | 0.01 |
|---|---|---|---|---|
| Probability of exceedance in 50 years | 2 % | 5 % | 10 % | 40 % |
| Sa (0.05) | 0.717 | 0.510 | 0.370 | 0.161 |
| Sa (0.1) | 1.101 | 0.791 | 0.573 | 0.246 |
| Sa (0.2) | 1.321 | 0.949 | 0.693 | 0.300 |
| Sa (0.3) | 1.331 | 0.953 | 0.692 | 0.296 |
| Sa (0.5) | 1.185 | 0.836 | 0.597 | 0.243 |
| Sa (1.0) | 0.704 | 0.466 | 0.313 | 0.115 |
| Sa (2.0) | 0.418 | 0.267 | 0.172 | 0.060 |
| Sa (5.0) | 0.131 | 0.074 | 0.038 | 0.012 |
| Sa (10.0) | 0.046 | 0.025 | 0.013 | 0.004 |
| PGA (g) | 0.593 | 0.425 | 0.307 | 0.130 |
| PGV (m/s) | 0.850 | 0.577 | 0.394 | 0.146 |

**Notes:** Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 $m/s^2$). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

## References

**National Building Code of Canada 2015 NRCC no. 56190;** Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

**Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)**
**Commentary J**: Design for Seismic Effects

**Geological Survey of Canada Open File 7893** Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

WESTBROOK Consulting Ltd.

October 9, 2024

**WestUrban Developments Ltd.**
#21-3318 Oak Street
Victoria, BC
V8X 1R1

Attn: Frank Limshue

**Re: 3601 Olympian Way – Preliminary Stormwater Management Plan**

Dear Mr. Limshue,

Thank you for contacting Westbrook Consulting regarding engineering services for the above-named project.

## PROJECT UNDERSTANDING

We understand you are proposing to construct a 6-Storey, 90-Unit apartment building with suspended slap and surface parking at the above-mentioned address and are seeking a preliminary storm water management plan to accompany the environmental report for the project.

## BACKGROUND

The project site is situated within the Phase 1 portion of the Olympic View Golf Course development, at the southeast corner of Latoria Road and Olympian Way. The site is a lightly forested hillside with rocky outcrops and shallow overburden layer (<500mm thick).

Based on CRD GIS mapping, the site slopes downwards towards the southeast to a wetland located on the property immediately adjacent to the site, 595 Latoria Road. The CRD GIS shows the wetland discharging to North Latoria Creek.

Due to the immediate receiving environment being a fish bearing creek (Latoria Creek) the release rate from the development will be set at the predevelopment peak 2-year storm, considered to be the channel forming event, with the remaining volume of runoff being detained onsite. Treatment of runoff from the roof will be required for total suspended solids (TSS), and from the parking lot for TSS, hydrocarbons, and 6PPD-q.

Although the stormwater management plan for Phase 1 of the Olympic View development, prepared by WSP, and dated September 23,2021, anticipated the project site as having its post development runoff directed to the wetland to the southwest, the site elevations prevent it from happening, and instead the runoff will be directed northward toward Latoria Creek.

Based on the preceding onsite detention and treatment will need to occur.

## STORM WATER MANAGEMENT – DETENTION / TREATMENT

Detention is to occur within underground chambers, such as StormTech arch chambers or Graff EcoBlock chambers. The detention volume will be the difference between the predevelopment 2-year peak runoff rate and the various post development runoff rates.

The pre-development peak 2-year rate was calculated using the Rational formula using the Colwood IDF intensity of 26.40 mm/hr and the runoff coefficient as per TAC Table 1020.A for a rolling terrain with forested cover (R=0.50).

| Watershed Physiography | Surface Cover | | | | |
|---|---|---|---|---|---|
| | Impermeable | Forested | Agricultural | Rural | Urban |
| mountain (>30%) | 1.00 | 0.90 | - | - | - |
| steep slope (20-30%) | 0.95 | 0.80 | - | - | - |
| moderate slope (10-20%) | 0.90 | 0.65 | 0.50 | 0.75 | 0.85 |
| rolling terrain (5-10%) | 0.85 | 0.50 | 0.40 | 0.65 | 0.80 |
| flat (<5%) | 0.80 | 0.40 | 0.30 | 0.55 | 0.75 |
| return period 10-25 years | +0.05 | +0.02 | +0.07 | +0.05 | +0.05 |
| return period > 25 years | +0.10 | +0.05 | +0.15 | +0.10 | +0.10 |
| snowmelt | +0.10 | +0.10 | +0.10 | +0.10 | +0.10 |

The post development runoff rates were calculated using the Rational Formula with the Colwood IDF curve allowing for a 25% increase due to climate change. The rate for each design storm, of each duration, was then lessened by subtracting the pre-development 2-year peak runoff rate, the difference resulting in a volume to be stored, the maximum of which becomes the required storage volume (refer to the attached Calculation Table 1).

The resulting required detention volume is **38.45 m$^3$** with a release rate of **13.20lps**.

Total Suspended Solids (TSS) shall be limited such that removal of 80% of particles >50µm for the calculated release rate. Sizing of the required Stormceptor to remove 80% of the TSS was done using the manufacturer's sizing program and resulted in a Stormceptor EF03 for the site with a removal efficiency of 96% for particles greater than 50µm and allowing for oil-spill protection.

The chemical 6PPD-q is used to protect vehicle tires and its particles have been found to be highly toxic to certain species of salmon. Treatment of 6PPD-q is only recently being investigated and so far the treatment following best management practices is to direct affected runoff to treatment systems that permit, bioretention, infiltration, sorption, and settling (https://pubs.acs.org/doi/10.1021/acs.estlett.3c00203). All of these features are available in low impact development features such as bioswales and rain gardens. As such, it is recommended to sheet flow the parking area

## CONCEPT DESIGN

Figure 1, below shows the proposed concept design of the stormwater management system.

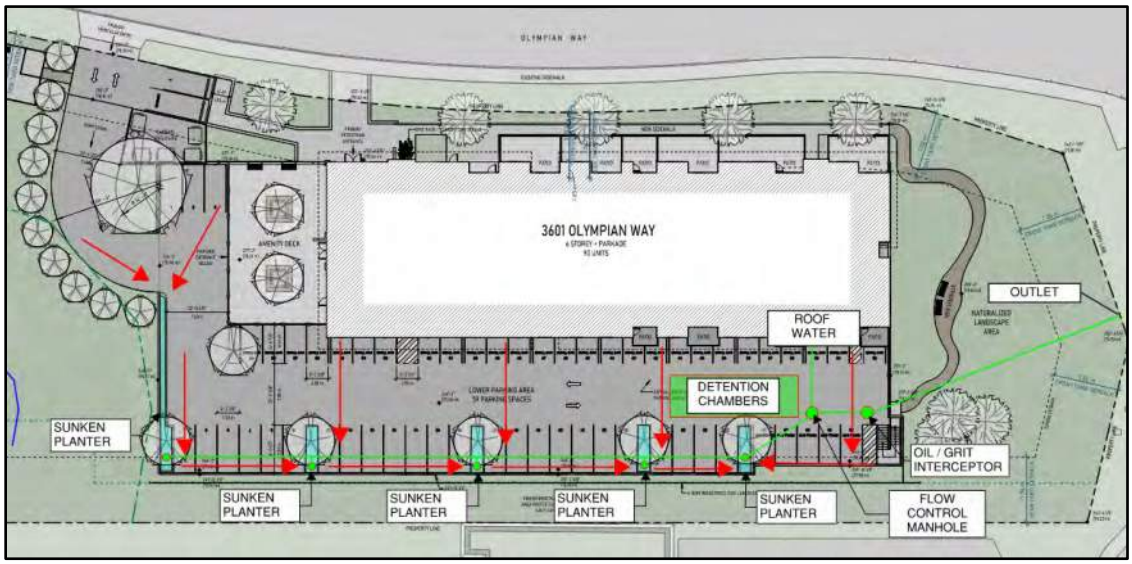



*Figure 1 – Concept Storm Water Management*

It is recommended to sheet flow the parking areas to the sunken planters in which the runoff will be allowed to accumulate to a 100 – 150mm depth. By directing runoff to the planters the parking lot runoff will be treated for TSS, 6PPD-q, and hydrocarbons.

The planters will have an underdrain to direct infiltrated / filtered runoff to the site drain pipe. A high flow overflow, in the form of a perched lawn drain, provides drainage for runoff events that exceed the infiltrative ability of the soil.

Drainage within the site drain will be directed to the flow control manhole which will restrict runoff from the site to the 2-year pre-development runoff rate, as described previously. Runoff rates that exceed the release rate will be directed to the detention system and then slowly release over time. A high flow bypass will be provided for runoff events that exceed the capacity of the designed system.

Roof water will be discharged directly to the flow control manhole site drain, prior to discharge from the site.

The flow control manhole will discharge to the Stormceptor described previously to ensure the TSS and hydrocarbons are removed prior to discharge to the fish bearing creek.

## SUMMARY

Based on the preliminary design drawings supplied, the as built information, and the project's stormwater management plan prepared by WSP, the proposed stormwater management system described above will meet the intent of the project SWM plan, Colwood Bylaws, and DFO regulations for treatment of the stormwater.

During the course of the detailed design the concept design will be vetted further to determine if improvements can be made. There may be an ability to increase the permeable surfacing within the parking area, thereby increasing the treatment area and decreasing the impervious footprint.

We trust the above meets your needs, if there is anything further or any questions, please do not hesitate to contact the undersigned.

Yours truly,

**WESTBROOK CONSULTING LTD.**

[redacted]

Bruce Crawshaw, P.Eng.
Principal

H:\PROJECTS\3999 3601 Olympian Way\02C Correspondence\L241003 SWM.docx
2024-10-09 1:22 PM

**WESTBROOK Consulting Ltd.**

## Calculation Table 1: Detention Calculations

Westbrook Consulting
115 - 866 Goldstream Avenue
Victoria, British Columbia V9B 0J3

Phone: (250) 391-8592
Fax: (250) 391-8593

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | 3601 Olympian Way - PRELIMINARY | Calculated By: | BC | Date: | July 3, 2024 |
| Project File Number: | 3999.03 | Checked By: | | Date: | |

**Pre Development Flow**

| Q (l/s) = | R | A ha | I mm/hr | N |
|---|---|---|---|---|
| | 0.5 | 0.36 | Variable | 2.778 |

| $Q_{pre\ l/s}$ | Storm Event | | | | | |
|---|---|---|---|---|---|---|
| Duration | 2 | 5 | 10 | 25 | 50 | 100 |
| 5 | 19.08 | 27.18 | 32.52 | 39.30 | 44.34 | 49.32 |
| 10 | 13.20 | 18.18 | 21.42 | 25.56 | 28.62 | 31.68 |
| 15 | 10.62 | 14.10 | 16.38 | 19.26 | 21.42 | 23.52 |
| 30 | 7.26 | 9.42 | 10.86 | 12.72 | 14.04 | 15.36 |
| 60 | 5.16 | 6.42 | 7.26 | 8.28 | 9.06 | 9.84 |
| 120 | 4.02 | 4.98 | 5.64 | 6.42 | 7.02 | 7.62 |
| 360 | 2.82 | 3.48 | 3.90 | 4.44 | 4.86 | 5.28 |
| 720 | 2.04 | 2.64 | 3.00 | 3.42 | 3.78 | 4.14 |
| 1440 | 1.32 | 1.80 | 2.10 | 2.46 | 2.70 | 3.00 |

| Intensity | Storm Event IDF COLWOOD | | | | | |
|---|---|---|---|---|---|---|
| Duration | 2 | 5 | 10 | 25 | 50 | 100 |
| 5 | 38.16 | 54.36 | 65.04 | 78.60 | 88.68 | 98.64 |
| 10 | 26.40 | 36.36 | 42.84 | 51.12 | 57.24 | 63.36 |
| 15 | 21.24 | 28.20 | 32.76 | 38.52 | 42.84 | 47.04 |
| 30 | 14.52 | 18.84 | 21.72 | 25.44 | 28.08 | 30.72 |
| 60 | 10.32 | 12.84 | 14.52 | 16.56 | 18.12 | 19.68 |
| 120 | 8.04 | 9.96 | 11.28 | 12.84 | 14.04 | 15.24 |
| 360 | 5.64 | 6.96 | 7.80 | 8.88 | 9.72 | 10.56 |
| 720 | 4.08 | 5.28 | 6.00 | 6.84 | 7.56 | 8.28 |
| 1440 | 2.64 | 3.60 | 4.20 | 4.92 | 5.40 | 6.00 |

| Release Rate = | 13.20 lps |
|---|---|

**Post Development Flow**

| Q (l/s) = | R | A ha | I mm/hr | N | Climate Change |
|---|---|---|---|---|---|
| | 0.9 | 0.36 | Variable | 2.778 | 25% |

| $Q_{post\ l/s}$ | Storm Event | | | | | |
|---|---|---|---|---|---|---|
| Duration | 2 | 5 | 10 | 25 | 50 | 100 |
| 5 | 42.93 | 61.16 | 73.18 | 88.43 | 99.77 | 110.98 |
| 10 | 29.70 | 40.91 | 48.20 | 57.51 | 64.40 | 71.29 |
| 15 | 23.90 | 31.73 | 36.86 | 43.34 | 48.20 | 52.92 |
| 30 | 16.34 | 21.20 | 24.44 | 28.62 | 31.59 | 34.56 |
| 60 | 11.61 | 14.45 | 16.34 | 18.63 | 20.39 | 22.14 |
| 120 | 9.05 | 11.21 | 12.69 | 14.45 | 15.80 | 17.15 |
| 360 | 6.35 | 7.83 | 8.78 | 9.99 | 10.94 | 11.88 |
| 720 | 4.59 | 5.94 | 6.75 | 7.70 | 8.51 | 9.32 |
| 1440 | 2.97 | 4.05 | 4.73 | 5.54 | 6.08 | 6.75 |

| Volume m³ | Required Storage Volume | | | | | |
|---|---|---|---|---|---|---|
| Duration | 2 | 5 | 10 | 25 | 50 | 100 |
| 5 | 8.92 | 14.39 | 17.99 | 22.57 | 25.97 | 29.33 |
| 10 | 9.90 | 16.63 | 21.00 | 26.59 | 30.72 | 34.85 |
| 15 | 9.63 | 16.68 | 21.29 | 27.13 | 31.50 | 35.75 |
| 30 | 5.65 | 14.40 | 20.23 | 27.76 | 33.10 | 38.45 |
| 60 | -5.72 | 4.50 | 11.30 | 19.55 | 25.88 | 32.18 |
| 120 | -29.88 | -14.33 | -3.67 | 9.00 | 18.72 | 28.44 |
| 360 | -147.96 | -115.99 | -95.47 | -69.34 | -48.82 | -28.51 |
| 720 | -371.95 | -313.63 | -278.64 | -237.60 | -202.61 | -167.62 |
| 1440 | -883.87 | -790.56 | -731.81 | -661.82 | -615.17 | -557.28 |

| | |
|---|---|
| Required Detention = | 38.45 m3 |
| Required Release Rate = | 13.20 lps |

## *Section 5. Environmental Monitoring*

An environmental monitor will be retained before the initiation of any tree clearing or construction. The clearing boundary will be inspected to ensure that those trees located along the SPEA boundary whose protective root zone extend beyond the SPEA are adequately protected. An environmental monitoring program must be established for the duration of construction. This monitoring program is in place in case of heavy rain events and to also ensure the delineation of the SPEA boundary and the protection of the SPEA. A site visit must occur before any construction takes place to discuss sediment and erosion control measures and to inspect the SPEA and tree protection fencing. If any heavy rain events occur during the construction period a site visit will be necessary.

The environmental monitor will work with the construction foreman to maintain a sediment control system (SCS). During site clearing and construction, the responsibility of the monitor will be to:

- Examine the adequacy of the sedimentation and control works in reaching acceptable sediment levels as recommended by DFO/WLRS guidelines (ie. total suspended solids and turbidity) discharged from the site;
- Make recommendations to the construction foreman on improving the SCS, if required;
- Instruct the construction foreman as to the site requirements and design specifications on sediment control structures and complete an inspection of such structures on a routine basis, particularly during periods of inclement weather;
- Require that works be stopped in the event of malfunctions of the sediment control system or contravention of discharge limits;
- Ensure that runoff is diverted from cleared areas by use of swales or low berms and that runoff is routed to the appropriate sedimentation control structures. In environmentally sensitive or problem areas, the monitor will need to oversee the installation and maintenance of sediment control structures;
- Review stockpiling methods for excavated materials to ensure that they are placed in an appropriate location and stored properly (eg. covered with tarps); and,
- Recommend mitigation measures and ensure expeditious implementation of these if activities are found to have the potential for environmental impact or poor water quality runoff.

Maintaining the recommended SPEA zones and undertaking sediment and control measures and having a monitoring program in place should ensure that construction will not cause Serious Harm to fish populations and habitat. Once construction has been completed and any replanting has occurred a site visit will be necessary in order to check on the status of the SPEA and to sign off on a post development report. This report will be uploaded onto the notification site within 6 months of the project completion.

## *Section 6. Photos*



Photo 1: Open water portion of wetland located in the north part of the Site



Photo 2: Looking east across the wetland to the adjacent development



Photo 3: Narrowing of wetland at the south end of the Site

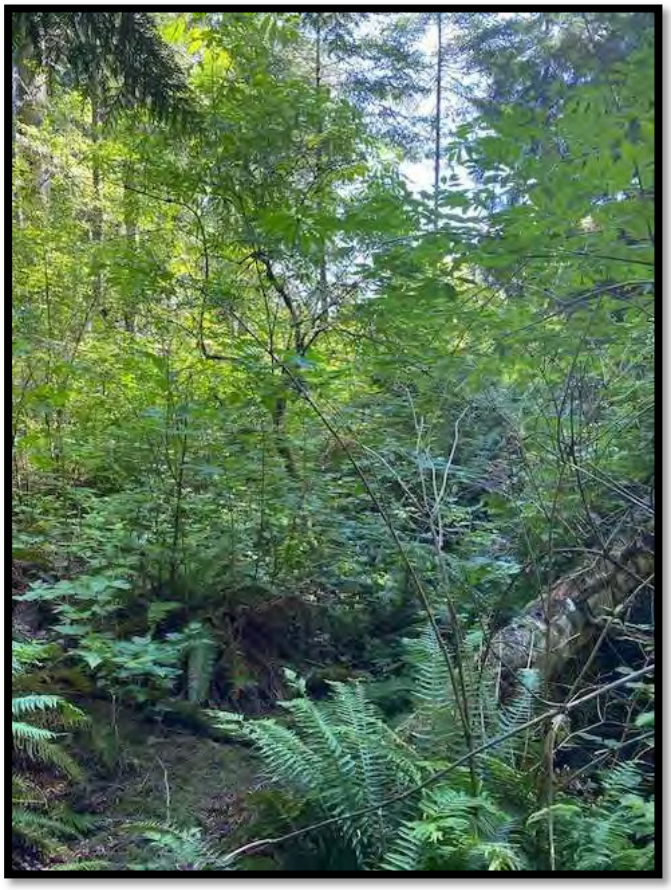


Photo 4: Dense riparian vegetation adjacent to wetland

## *Section 7. Professional Opinion*

**Qualified Environmental Professional opinion on the development proposal's riparian assessment.**

Date [ September 23, 2024 ]

1. I/We Susan Blundell, Margaret Symon, Bruce Crawshaw and Austin Baird

hereby certify that:

a) I am/We are qualified environmental professional(s), as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am/We are qualified to carry out the assessment of the proposal made by the developer, B.C. Housing, which proposal is described in section 3 of this Assessment Report (the "development proposal"),
c) I have/We have carried out an assessment of the development proposal and my/our assessment is set out in this Assessment Report; and
d) In carrying out my/our assessment of the development proposal, I have/We have followed the specifications of the Riparian Areas Protection Regulation and assessment methodology set out in the minister's manual; AND

2. As qualified environmental professional(s), I/we hereby provide my/our professional opinion that:

a) [ ] the site of the proposed development is subject to undue hardship, (**if applicable, indicate N/A otherwise**) and
b) [ X ] the proposed development will meet the **riparian protection standard** if the development proceeds as proposed in the report and complies with the measures, if any, recommended in the report.