



March 24, 2021

Mr. Brendan Yee  
Squamish Lands LP  
1201 – 838 West Hastings Street  
Vancouver, BC V6C 0A6

Dear Mr. Yee:

**Re: Invasive Species Management Plan  
Waterfront Landing Project – Phase 2 and Phase 3  
1500 Highway 99, Squamish, BC  
Project No.: 12022**

Keystone Environmental Ltd. (Keystone Environmental) was retained by Bosa-Kingswood Properties (Squamish) Inc (the Developer) to prepare an invasive species management plan for the North Park at the Waterfront Landing development. Waterfront Landing is located at 1500 Highway 99, Squamish BC (the Site).

## 1. EXISTING CONDITIONS

The Project is located on the east of the Mamquam Blind Channel within the District of Squamish within the Waterfront Landing Development Permit Area (DPA) and south of the CN railroad crossing. A detailed bio inventory assessment was conducted to assess the current Site conditions. The invasive species identified during this survey included Himalayan blackberry (*Rubus discolor*), Scotch broom (*Cytisus scoparius*), and English Holly (*Ilex aquifolium*).

All invasive species are to be removed in the park, between Outfall 1 and Outfall 2, and in the Crown land parcel fronting the park (See Figure 1). There are also unmapped species in the crown land parcel which are difficult to show on the map as they are sporadically located. Required removal method will be area-specific, depending on the location of species. Areas within the 5m setback or below the High High Water Mark (HHWM) will be conducted by hand to avoid damaging existing native species to remain. Invasive species outside the setback may be removed by machine.

## 2. INVASIVE PLANT MANAGEMENT TECHNIQUES

### 2.1 Himalayan Blackberry

Himalayan blackberry is typically a biennial plant found on disturbed sites along stream and road corridors, parklands and parcel boundaries, mixed open forests and coniferous forest edges. It spreads by stem and root fragments as well as dispersing seeds through berries.

Established populations of mature Himalayan blackberry are difficult to control and removal of the extensive canes and leads is sometimes required to be completed with an excavator or equivalent before the root system may be removed. Use of machinery in the vegetated shrub area of the park should not occur if it will remove native plants or harm existing tree roots. Hand removal will be required in the Crown land parcel or in areas below the HHWM. An excavator may be used if fill is proposed to extend into these areas. The root nodules (crowns) and fragments are required to be removed to reduce the potential for re-infestation. It is critical that the contractor contain and remove fragments of invasive plants and roots to prevent re-infestation, using tarps, plastic sheets or equivalent measures, and raking cleared areas for fragments.

Where removal works require an excavator, brush cutters or equivalent, due care and attention will be required when working around existing native vegetation to be retained. Additionally, any new blackberry emerging from the prior blackberry removal of 2018 must be removed. The methods of removal will be left to the contractor to determine. The following general removal methods were considered:

- Remove as much of the above ground blackberry stems as possible by mowing, brushing, or cutting, taking care not to disturb existing native trees.
- Use excavators, brush saws and/or hand tools to remove the roots of Himalayan blackberries. The roots may be found up to 1 m or more below the surface and it is critical to remove the root crowns and as much of and roots as possible.
- Use due care and attention when grubbing and clearing near native trees to be retained to prevent root, bole and stem damage. Use hand-held equipment where possible when clearing blackberry material within the drip line of native trees.
- Shake soil loose from rhizomes and ensure that no plant material is left in the soil as blackberry can become re-established from even small root fragments.
- Use tarps, plastic sheets or equivalent to contain plant fragments for disposal, and dispose off-Site at a facility that accepts invasive plant material.
- Invasive plant material may be disposed of at the Squamish Landfill. Associated soil will be disposed of at the Ecowaste facility in Richmond, BC or other facility that accepts the soil from invasive plant areas.
- Hand removal will be required where species are located in the Crown land parcel or below the HHWM. If fill is proposed to extend into these locations, then machinery-based removal may be used.

## 2.2 Scotch Broom

Scotch broom is an evergreen shrub that spreads quickly through plentiful seed pods. It is typically found in open disturbed areas. Photosynthetic stems enable year-long growth, allowing Scotch broom to outcompete native plant species with shorter growing periods.

The preferred method of Scotch broom management is manual control using the following methodology:

- Use an excavator, weed wrench or equivalent to remove the shrubs and roots. Root fragments may be raked out with an iron hoe or equivalent.
- Careful attention must be paid to ensure any seed pods that may have fallen on the ground are bagged and disposed of off-Site.
- Use tarps, plastic sheets or equivalent to contain plant fragments for disposal, and dispose off-Site at a facility that accepts invasive plant material.
- Invasive plant material may be disposed of at the Squamish Landfill. Associated soil will be disposed of at the Ecowaste facility in Richmond, BC or other facility that accepts the soil from invasive plant areas.
- Hand removal will be required where species are located in the Crown land parcel or below the HHWM. If fill is proposed to extend into these locations, then machinery-based removal may be used.

## 2.3 English Holly

English ivy is an evergreen shrub or small tree. Holly can easily grow in both sunny and shady conditions which gives it a significant advantage over native species. Additionally, holly grows rapidly causing it to quickly shade out native plants. Its roots are also able to effectively outcompete native species for nutrients and water. Holly seeds are easily carried and spread by birds.

Manual control is the preferred method for management of English holly using the following methods:

- Hand-pull small seedlings.
- Cut mature trees at ground level, being sure to remove all plant material including berries which contain seeds.
- Herbicides applied to cut stumps may be effective to prevent regrowth.
- Use tarps, plastic sheets or equivalent to contain plant fragments for disposal and dispose off-Site at a facility that accepts invasive plant material.
- Invasive plant material may be disposed of at the Squamish Landfill. Associated soil will be disposed of at the Ecowaste facility in Richmond, BC or other facility that accepts the soil from invasive plant areas.

- Hand removal will be required where species are located in the Crown land parcel or below the HHWM. If fill is proposed to extend into these locations, then machinery-based removal may be used.

### 3. POTENTIAL ENVIRONMENTAL IMPACTS

Invasive plant removal involves work within close proximity to the high-water mark of the Mamquam Blind Channel, and upland forested and cleared areas of the Site. Considering the existing conditions at the Site and typical invasive plant removal techniques, the following potential environmental impacts were identified:

- Accidental spread of invasive vegetation into other areas of the Site and to off-Site areas.
- Trampling of native shrubs and understory vegetation and/or damage to native trees.
- Contamination of soils and/or the aquatic environment through accidental spills of hydrocarbons from machinery and equipment used to complete the works.
- Inputs of sediment and/or debris into the vegetated intertidal zone and the Mamquam Blind Channel.
- Harm or harassment of breeding birds/fledglings from vegetation removal conducted during the breeding season (generally between March 1 and August 31).

These potential impacts could cause serious harm to fish or adverse effects to terrestrial wildlife and require mitigation measures and strategies to be implemented by the contractor.

### 4. MITIGATION MEASURES AND BEST PRACTICES

To reduce the potential for impact to terrestrial and aquatic habitats at the Site and in adjacent areas, the following mitigation measures will be employed by the contractor performing invasive plant removal works.

#### 4.1 General

In order to protect existing native vegetation and prevent the dispersal of invasive species, the contractor will employ the following general measures:

- The QEP will perform environmental monitoring during removal works to confirm that the mitigation measures employed by the contractor are operating sufficiently, and document conditions at the Site and adjacent terrestrial and vegetated intertidal habitat (see Section 4.2).
- Native vegetation will be protected where possible as outlined in Section 4.3. Re-seeding of removal and access/egress areas will be completed by the contractor after removal works have been completed.
- The potential for erosion and off-Site migration of sediment or sediment-laden water will be reduced using berms, silt fences and equivalent measures to contain stormwater runoff from recently cleared/grubbed areas as outlined in Section 4.4.

- Water quality in the adjacent intertidal and subtidal areas of the Mamquam Blind Channel will be maintained to meet requirements for the protection of aquatic life (see Section 4.5).
- A pre-clearing survey will be completed by a QEP within three to five days of invasive plant removal works to search for nesting birds that could be affected (see Section 4.6). The pre-clearing survey(s) will be conducted by QEP, and will allow the contractor to clear areas surveyed without encounters to be cleared within five days. Wildlife encounters will be reported to the QEP on the day of the occurrence.
- A spill response plan (see Section 4.7) will be implemented by the contractor performing the plant removal works. Fuel transfer activities for machines and hand-held equipment will be conducted in designated upland areas located at least 30 m from the high water mark at the Site, using containment trays or equivalent to capture minor spills.
- Invasive plant material may be disposed of at the Squamish Landfill. Associated soil will be disposed of at the Ecowaste facility in Richmond, BC or other facility that accepts the soil from invasive plant areas.

## 4.2 Environmental Monitoring

A QEP will monitor the invasive plant removal works on behalf of the developer to document the performance of the mitigation measures and strategies employed to prevent impact to terrestrial and aquatic resources at the Site. The environmental monitor will perform the following tasks:

- Delineate areas of native trees to be removed with flagging or equivalent.
- Conduct a kickoff meeting on-Site with the contractor to review mitigation strategies and expectations.
- Inspect the mitigation measures and features at the Site, taking notes of construction activities, effectiveness of environmental protection measures and observed potential for adverse environmental effects.
- Take representative photographs of Project activities and any environmental protection measures implemented, as well as any other notable features or incidents.
- Measure water quality in watercourses or Site runoff.
- Where measures or practices are not functioning as intended or to the level required to sufficiently reduce risk to aquatic or terrestrial habitats, the environmental monitor will work with the contractor to identify adaptive management strategies the increase the chance of success for mitigation strategies.
- Provide guidance and assistance in the event of spills or environmental incidents.

It is anticipated that monitoring visits will be more frequent at project start-up and at more environmentally sensitive stages of the project (invasive vegetation clearing in close proximity to native trees to be retained) in order to ensure that mitigation measures are functioning as intended. The frequency of monitoring visits can be reduced once it has been shown that mitigation measures are functioning as intended and the risk of negative environmental impacts is reduced.

### 4.3 Protecting Existing Native Vegetation and Re-seeding Removal Areas

The existing native trees, shrubs and graminoids will be retained and avoided where possible to minimize the area impacted that may be utilized by wildlife and encourage recolonization of native plants to help compete with invasive plants. The following measures and best practices are provided to reduce the potential for unnecessary damage or loss of native vegetation:

- Prior to the start of invasive species removal, delineate areas of vegetation clearing in the field and clearly identify all native trees to be retained.
- Flagging tape, exclusion fence or equivalent will be used to delineate areas for native tree retention.
- Where practicable, avoid damaging or destroying native trees and shrubs during invasive plant removal works and access/egress. Avoid areas delineated by the environmental monitor for native tree retention.
- Invasive species within the rooting zone of native trees will be removed using hand tools where practicable to reduce damage to native vegetation while still removing as much of the invasive plant material as possible.
- Use smaller machines to more easily navigate between existing native trees and shrubs, and make use of existing cleared areas in developing access/egress routes.
- Seeding of native species within the setback area under the supervision of a QEP.
- Equipment operators will take care when developing access and performing the removal works to avoid damaging native tree boles, roots or overhanging limbs.
- Conduct seeding soon after clearing to minimize soil erosion and invasive species regrowth.
- If necessary to prevent erosion or to suppress invasive species regrowth, install geotechnical fabric, mulch, coconut matting or other applications after removal works.

Re-seeding of the removal and machine access/egress areas will be completed to minimize soil erosion and encourage native graminoids to help compete against invasive species regrowth. Additional planting of native shrubs and trees will be completed separately from the invasive plant removal works at a later date.

The following specifications are provided for the seed mix:

- Apply the native coastal revegetation seed mix outlined in Table 1, or equivalent native mix approved by the QEP. Seeding should be conducted in fall (September to October) to reduce the requirement for watering, provided the removal areas have been sufficiently prepared or contained to reduce the potential for erosion and off-Site migration of sediment.
- Imported growing medium, if required, is to be free of any subsoils, roots, noxious grasses, weeds, toxic material and foreign objects.
- The invasive species removal area should be monitored throughout the growing season and the stems and roots of any new invasive species should be removed.

**Table 1 80% Native Forbs Grass Seed Mix Roadside Riparian Coastal Seed Mix**

Supplier	Premier Pacific Seeds Ltd		
Application Type	Coastal roadside riparian		
Function	Fast growing Erosion and sediment control Pollinator attractant Mitigate invasive plant growth in disturbed soils Low growth height		
Sowing Time	Any time, ideally not in prolonged drought or frost		
Sowing Rate	20–30 kg/ha		
Cost	\$22.50/kg		
Notes	Annual ryegrass establishes quickly. If the planting area is highly disturbed and subject to significant erosion or is in proximity to invasive plants and/or invasive plant root material, this is the preferred seed mix.		
Seed Mix	% by Weight	Seeds / lb	% by Seed Count
<i>Achillea millefolium</i> , Yarrow*	0.25	2,800,000	1.24
<i>Agrostis scabra</i> , Ticklegrass*	1.00	4,000,000	7.06
<i>Anaphalis margaritacea</i> , Pearly Everlasting*	0.25	8,000,000	3.53
<i>Aster subspicatus</i> , Douglas Aster*	0.25	1,120,000	0.49
<i>Deschampsia cespitosa</i> , Tufted Hairgrass*	5.00	2,100,000	18.55
<i>Festuca occidentalis</i> , Western Fescue*	5.00	499,000	4.41
<i>Festuca ovina</i> , Sheep's Fescue Quatro	21	530,000	19.89
<i>Festuca rubra var. rubra</i> , Creeping Red Fescue	15.00	455,000	12.05
<i>Festuca rubra</i> , Native Red Fescue*	20.00	600,000	21.19
<i>Lolium multiflorum</i> , Annual Ryegrass (Diploid)	30.00	217,000	11.50
<i>Lupinus polyphyllus</i> , Big Leaf Lupine*	2.00	23,000	0.08
*native to costal British Columbia	100.00		100.00

#### 4.4 Erosion and Sediment Control

The contractor completing the invasive species removal works will prepare and implement a Site-specific erosion and sediment control (ESC) plan that incorporates the following mitigation measures and best practices:

- Minimize disturbance of vegetation outside of invasive species removal areas as a first defense in the control of erosion and sediment release.

- Plan project activities to minimize the generation of sediment-laden water within the area of works. Contain stormwater runoff from cleared/grubbed areas to prevent off-Site migration of sediment-laden water.
- Avoid working with machines during precipitation events to minimize the mobilization of disturbed soils.
- If soil material excavated from removal works is to be stockpiled on site, it should be placed on and covered by tarps or plastic sheets to reduce the potential for erosion.
- Locate material stockpiles at least 30 m away from the high water mark of the Mamquam Blind Channel.
- In wet conditions, erosion control should be implemented immediately upon completion of any clearing operations.
- Redirect the flow of storm water away from areas of exposed soil.
- Implement sediment control measures such as berms, silt fence, straw bales or other techniques to contain and/or treat sediment-laden runoff from entering the Mamquam Blind Channel. Water quality requirements are discussed in Section 4.5.
- For loose/disturbed soils, coconut matting or other forms of slope and soil stabilization methods may be used when cleared areas cannot be re planted immediately after clearing.

#### **4.5 Water Quality Management**

Surface water quality in all receiving waters will adhere to the applicable water quality criteria from the British Columbia Water Quality Guidelines for the Protection of Aquatic Life and the Fisheries and Oceans Canada Land Development Guidelines during Project works. Water quality observations will meet the following criteria:

- Contain less than 25 mg/L of Total Suspended Solids (TSS) above background during normal dry weather.
- Contain less than 75 mg/L of TSS above background during rainfall events of >12.5 mm in 24 hours.
- Not exceed 8 Nephelometric Turbidity Units (NTU) above background over a 24-hour period in all waters during clear flows.
- Not exceed 2 NTU above background for a duration of 30 days in all waters during clear flows.
- Not exceed 5 NTU above background ranges from 8 NTU to 50 NTU during high flows or in turbid waters.
- Not exceed 10% above background ranges >50 NTU at any time during high flows or in turbid waters.
- Be within the acceptable pH range of 6.5–9.0.

In the event of an exceedance of the acceptable water quality criteria, work will be temporarily suspended and additional mitigation measures will be implemented until water quality stabilizes within the acceptable range.



#### 4.6 Wildlife Management

The following measures and best practices will be employed by the contractor performing the invasive plant removal works to reduce the potential for impact to wildlife at the Site:

- The developer will hire a QEP to perform a pre-clearing survey of the invasive plant removal area within five days of works commencing to search for nesting song birds and/or raptors that could be affected by the removal works.
- The pre-clearing survey(s) will allow the contractor to clear areas surveyed without encounters to be cleared within five days. Additional surveys will be required to be performed by the QEP for areas that were not surveyed or were surveyed more than five days before clearing is to begin.
- The contractor will report apparent nests, dens, aggregation areas or migration routes to the environmental monitor immediately upon encountering them, and refrain from disturbing those areas until an appropriate salvage or management plan is implemented.
- Remove all food waste and wrapping material off-Site daily to deter the attraction of wildlife. Do not dispose of organic waste at the Site.
- Wildlife encounters will be reported to the QEP on the day of the occurrence.
- Contact the environmental monitor immediately in the event an injured or dead animal is found in the work area.

#### 4.7 Spill Prevention and Response

The contractor shall prepare and implement a Site-specific Spill Response Plan during invasive species removal. The Spill Response Plan will include the following general mitigation measures designed to mitigate environmental impacts from accidental spills or equipment failures:

- Fuel transfer activities for machines and hand-held equipment will be conducted in designated upland areas located at least 30 m from the high water mark at the Site, using containment trays or equivalent to capture minor spills.
- Equipment working within 30 m of the high water mark of the Mamquam Blind Channel will use non-toxic, biodegradable oils and lubricants.
- Machines and equipment will not be driven onto the foreshore below the high water mark of the Mamquam Blind Channel.
- Machinery employed will be inspected for leaks, worn hoses or fittings, and appropriate repairs will be completed prior to mobilization.
- Appropriate spill kits equipped with the appropriate type and quantity of containment and clean-up products (e.g., absorbent pillows/pads, booms) are to be on-Site at all times.
- Used spill response materials will be bagged in multiple layers of heavy-duty plastic bags, labelled, and disposed of appropriately.
- Spills of any quantity will be immediately contained, cleaned up and reported to the Environmental Monitor.
- Contractors will ensure all workers on-Site are familiar with the Spill Response Plan and are appropriately trained in the use of spill control measures.

- The contractor will follow the guidelines on reporting spills in BC and reportable substances and quantities specified in the Spill Reporting Regulation of the *Environmental Management Act* of British Columbia. Spill reporting requirements will be included in the contractor's Spill Response Plan.

## 5. CLOSURE

Invasive plant removal works proposed are be expected to have a low risk of harm to terrestrial and aquatic habitats at the Site and adjacent lands, provided the mitigation measures and best practices included in this report are implemented effectively.

## 6. STATEMENT OF LIMITATIONS

Recommendations and guidelines presented in this plan are based upon (i) a review of available documentation and records, (ii) discussions with available personnel and regulatory representatives, (iii) review of the terms and conditions for planned construction, and (iv) observations of the Site and surrounding lands. Consequently, while the recommendations and guidelines presented in this report have been prepared in a manner consistent with that level of care and skill normally exercised by other members of the environmental science and engineering profession practicing under similar circumstances in the area at the time of the performance of the work, this Invasive Species Management Plan is intended to provide information and to suggest strategies to remove invasive species at the Site, but not necessarily eliminate, the potential for environmental impacts to occur as a result of planned work activities at the Site.

This report has been prepared solely for the internal use of Bosa-Kingswood Properties pursuant to the agreement between Keystone Environmental Ltd. and Bosa-Kingswood Properties. By using this letter report Bosa-Kingswood Properties agrees that they will review and use the letter report in its entirety. Any use which other parties make of this letter report, or any reliance on or decisions made based on it, are the responsibility of such parties. Keystone Environmental Ltd. accepts no responsibility for damages, if any, suffered by other parties as a result of decisions made or actions based on this letter report.

This report was prepared by Stephanie Davis and reviewed by Warren Appleton. Warren Appleton is the professional of record for this report.

Sincerely,

**Keystone Environmental Ltd.**

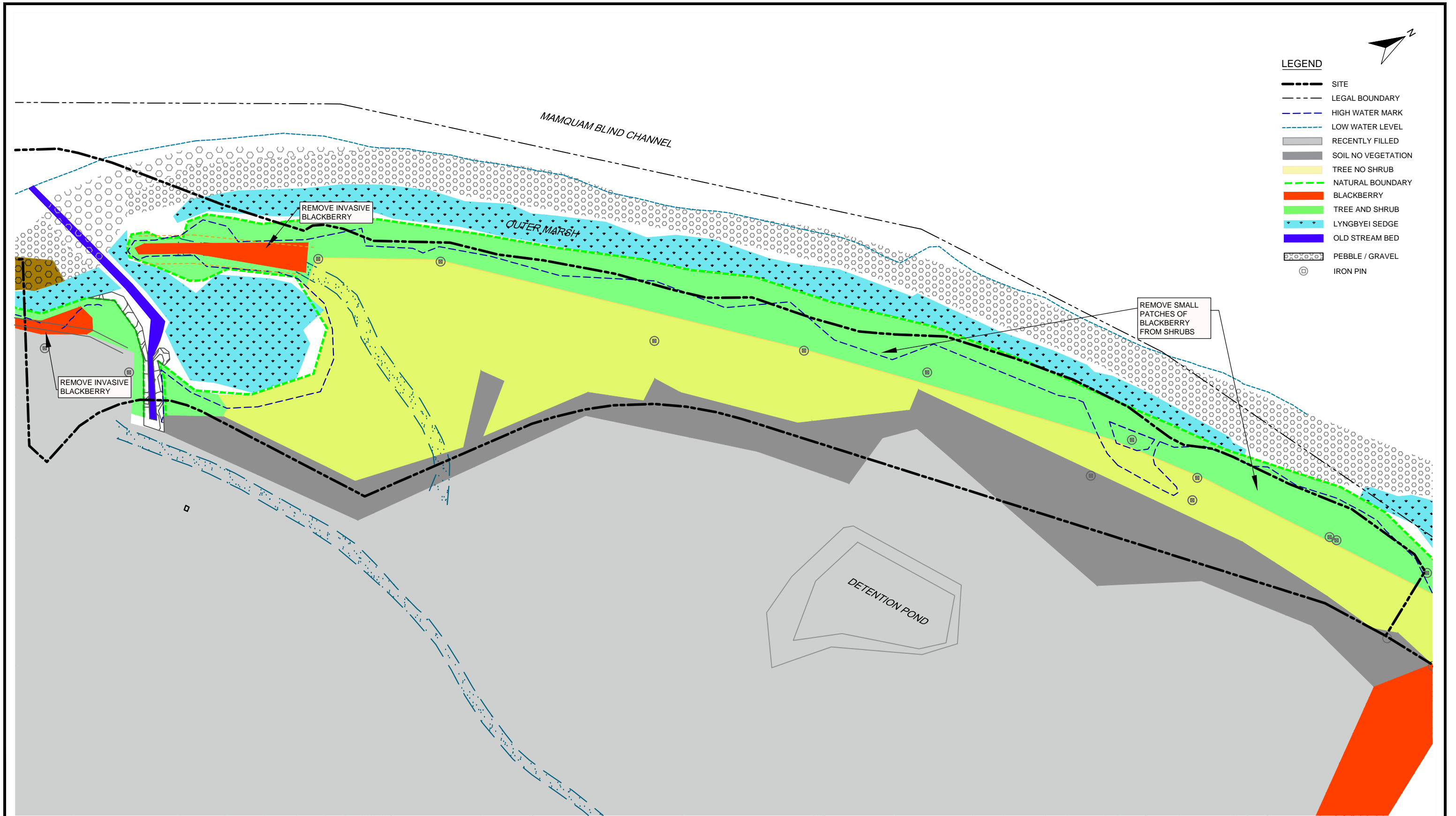
Warren Appleton, R.P.Bio.  
Project Manager

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### ATTACHMENT:

- Figure 1: Invasive Species Removal

**FIGURE**



- LEGEND**
- SITE
  - LEGAL BOUNDARY
  - - - HIGH WATER MARK
  - - - LOW WATER LEVEL
  - RECENTLY FILLED
  - SOIL NO VEGETATION
  - TREE NO SHRUB
  - NATURAL BOUNDARY
  - BLACKBERRY
  - TREE AND SHRUB
  - LYNGBYEI SEDGE
  - OLD STREAM BED
  - PEBBLE / GRAVEL
  - IRON PIN

REMOVE INVASIVE BLACKBERRY

REMOVE INVASIVE BLACKBERRY

REMOVE SMALL PATCHES OF BLACKBERRY FROM SHRUBS

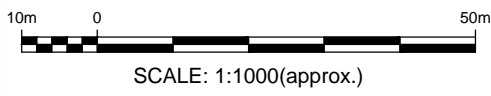
MAMQUAM BLIND CHANNEL

OUTER MARSH

DETENTION POND



NOTES:  
 1. THIS DRAWING IS FOR GENERAL INFORMATION ONLY.  
 LOT BOUNDARIES AND FEATURES ARE APPROXIMATE.  
 2. BASE PLAN PROVIDED BY OTHERS.



1500 Highway 99 Squamish, B C Squamish Lands LP		
REVISION No. 1	DATE June. 2019	PROJECT No. 12022-02

**Figure 1**  
 Invasive Species Removal