BENCHMARK ENVIRONMENTAL SERVICES

Ecosystem Restoration Plan

New Denver, BC

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1. Introduction

Benchmark Environmental Services is pleased to present the following Ecosystem Restoration Plan (ERP) to the Slocan Lake Garden Society (SLGS) and the Village of New Denver. This ERP outlines recommended actions which would help the SLGS and the Village of New Denver improve the ecological health of two sections of shoreline on the Slocan Lake. The ERP also factors in social values associated with both of the sites. Both sites are located within the municipal boundaries of the Village of New Denver.

2. Site Description and Prescribed Treatments for Bellevue Street

2.1. Site Description

The Bellevue St site is a linear strip of land approximately 170 metres in length and 20 metres in width. The site is adjacent to both Slocan Lake and the Mori Trail. It is a west facing site which is mostly situated on a steep slope averaging 70% along the length of the site. The elevation at the base of the slope is 545m. The site is located below Bellevue St; a residential street located within the village of New Denver. The land is owned by the Province of BC.

There are two degraded areas within the site, and therefore two treatment units. The first treatment unit (TU1) is located in the middle of the site on the slope and is approximately 900 m^2 in size. Over the past few years, mature trees have been cut on the site which has generated an invasive weed response and some erosion. Invasive weeds are primarily orange hawkweed *(Hieracium aurantiacum)* and St. John's wort *(Hypericum perforatum).* Also of concern is the fact that residents have been using the open patch to dump yard waste which has enabled the growth of domestic species such as common lilac *(Syringa vulgaris)* and rhubarb (*Rheum rhabarbarum).*

The second treatment unit (TU2) is located at the south end of the site on a small, flat area approximately 400 m^2 in size. This treatment unit was previously a healthy stand of aspens which were girdled in the fall of 2010 and removed by the village in the spring of 2011. Similar to TU1, the opening of the canopy has also generated a weed response consisting primarily of orange hawkweed.

Figure 1: Treatment Unit 1, Bellevue St

Figure 2: Girdled tree on Treatment Unit 2, February 2011

Figure 3: Treatment Unit 2 after girdled trees were removed, spring 2011.

2.2 Ecological Values

The Bellevue St treatment area is characterized by mixed forest dominated by large Douglas firs *(Pseudotsuga menziesii)* but also consisting of white pine (*Pinus monticola),* western redcedar *(Thuja plicata,* and *paper* birch *(Betula papyrifera).* Mature black cottonwoods *(Populus balsamifera)* are present along the water's edge below the treatment units. Shrubs on the site include Douglas maple *(Acer glabrum),* Saskatoon berry *(Amelanchier alnifolia),* common snowberry *(Symphoricarpos albus),* tall Oregon grape *(Mahonia aquifolium),* sitka alder *(Alnus crispa),* mock orange *(Philadelphus lewisii),* blue elderberry *(Sambucus caerulea),* nootka rose *(Rosa nutkana),* thimbleberry *(Rubus parviflorus),* birch-leaved spirea *(Spiraea betulifolia)* and mountain ash *(Sorbus scopulina).*

This forest type provides excellent habitat for songbirds. Numerous species of songbirds extract seeds from Douglas fir cones or forage for seeds on the ground. The shrub species on the site also provide food and habitat for songbirds. Species such as black-capped chickadee (*Poecile atricapillus*), sparrows *(Passer spp.),* red-breasted nuthatch *(Sitta Canadensis),* dark-eyed junko *(Junco hyemalis),* pine siskin *(Spinus pinus),* spotted towhee *(Pipilo maculates)* and American robins *(Turdus migratorius*) are all supported by the fruit and seeds provided by the vegetation on this site. Lazuli buntings *(Passerina amoena)* have been observed using this area in the spring.

Primary cavity nesters such as northern flickers *(Colaptes auratus)* and pileated woodpeckers *(Dryocopus pileatus)* are supported by the tree species (primarily black cottonwood, Douglas fir and aspen) as well as the seeds, fruits and insects present in this forest type.

2.3 Social Values

There are several social values associated with the Bellevue St site. The Mori Trail is a public hiking trail which follows the lakeshore within the village boundaries. The trail provides beautiful views of Slocan Lake as well as access to several swimming holes and canoe launches. During the autumn of 2010 trees

and shrubs were girdled and in some cases cut, presumably to clear views of Slocan Lake that were obstructed by vegetation. The result of the vandalism was the closure of the Mori Trail due to public safety issues associated with danger trees. The trees have since been cleared and the trail re-opened, but the incident has caused a considerable social unrest.

2.4 Background Ecological Data

The Bellevue St treatment area is classified as Interior Cedar Hemlock Dry-Warm 01a (ICH dw 01a) according to the Biogeoclimatic Ecosystem Classification (BEC) system (British Columbia 1998). The BEC system is the system used by British Columbia's Ministry of Forests, Lands and Natural Resources as a method to classify and manage sites on an ecosystem-specific basis. More information about the BEC system can be found at the following url: http://www.for.gov.bc.ca/hre/becweb/index.html.

Site series is the BEC unit most commonly used by operational field staff to describe ecosystems on the site level. Site and soil conditions and the vegetation community are used to identify site series (British Columbia 1998). Site series 01a is currently under revision, however, on the Bellevue St treatment area this site series fits well with the draft revisions (MacKillop 2011) and therefore this site series is used as reference for the vegetation community. A recommended species list for this site has been compiled by consulting the BEC Vegetation Table for the ICH dw 01a and by compiling a list of species present within the healthy sections of the treatment area.

2.5 Planting Densities

Recommended planting densities for this site are 200 stems/hectare for trees and 400 stems/hectare for shrubs. These densities are slightly higher than those measured on healthy sections of the site. The soil on this site is extremely coarse and in some places will necessitate pocket planting into rock. Therefore some mortality (possibly up to 30%) is to be expected. Planting trees and shrubs at slightly higher densities than those found in the surrounding area accounts for mortality and will restore natural tree and shrub densities. This amounts to planting 18 trees, 37 shrubs on TU1 and 8 trees, 17 shrubs on TU2.

2.6 Treatment Goals for the Bellevue St Treatment Area

1. To provide habitat for songbirds.

2. To reduce the occurrence of invasive species by planting native shrubs and trees which will outcompete weed species.

3. To prevent erosion.

4. To discourage residents from dumping yard and garden waste over the bank.

2.7 Treatment Objectives for the Bellevue St Treatment Area

1.1 Plant native shrub species on both treatment units which are found in healthy stands of ICH dw 01a stands and also provide habitat value for songbirds. See table 1 for a list of recommended species.

1.2 Plant native trees which grow naturally in the ICH dw 01a but obstruct views to a lesser degree than Douglas fir. Paper birch is the recommended species for TU2. A mix of species listed in Table 1 is recommended for TU1.

2.1 Concentrate planting of larger shrubs (Saskatoon berry and mock orange) in areas where the canopy is open and invasive species are thriving. This will provide competition and shade to invasive species which are shade intolerant.

2.2 Plant deciduous trees in the open areas as they will provide shade in the summer when it is most needed to shade out invasive species.

2.3 Seed patches of bare mineral soil with a reclamation seed mix to decrease the opportunity for invasive species to establish themselves.

3.1 Plant conifers in areas where erosion is evident as the root systems will stabilize the slope over time.

4.1 Plant nootka roses along the top of the bank. These shrubs grow naturally on the top and bottom portions of the banks in healthy sections of the site. The roses will ameliorate the aesthetic value of the dump site, especially in spring/early summer when they are blooming. This is also the time of year when people are most likely to dump yard and garden waste. Also, people will be unwilling to get physically close to the thorny roses, so their presence should act as a deterrent.

Table 1: List of recommended tree and shrub species for the Bellevue St site

Trees	**Shrubs**
Western larch *(Larix occidentalis)*	Saskatoon berry *(Amelanchier alnifolia)*
Western white pine *(Pinus monticola)*	Tall Oregon grape *(Mahonia aquifolium)*
Paper birch *(Betula papyrifera)*	Mock orange *(Philadelphus lewisii)*
Ponderosa pine *(pinus ponderosa)*	Nootka rose *(rosa nutkana)*
	Common snowberry *(Symphoricarpos albus)*

2.8 Estimated Costs for Bellevue St. Treatment Unit 1

Table 2: Estimated Costs TU1 Bellevue St.

Material	Quantity	Unit price	Shipping	Estimated Cost (Including HST)
Plants	55 plants in 1 gallon pots	$16.00	$150.00	$1153.60
Seed*	1 20 kg bag Eco Green Interior Revegetation mix.	$97.00	$28.00	$119.84
Soil	4 yards	$35.00	included	$156.80
Gaia organic fertilizer (4-4-4)*	1 bag	$59.95	n/a	$67.14
Peat moss	3 bales	$24.00	n/a	$80.64
Consulting*	7hrs	$45.00	n/a	$352.80
Travel*	200 km	$0.50		$100.00
Book keeping and Admin Costs (as per original application)*				$700.00
Estimated Costs for ER Monitoring*				$675.00
			Total	**$3405.82**

2.9 Estimated Costs for Bellevue St. Treatment Unit 2

Table 3: Estimated Costs TU2 Bellevue St.

Material	Quantity	Unit price	Shipping	Estimated Cost (Including HST)
Plants	25 plants in 1 gallon pots	$16.00	$50.00	$504.00
Soil	2 yards	$35.00	included	$78.40
Peat moss	2 bales	$24.00	n/a	$53.76
			Total	**$636.16**

*These services/materials will be divided between the two treatment units.

3. Site Description and Prescribed Treatment for Kohan Reflection Garden Treatment Area

3.1 Site Description

The Kohan Garden Treatment Area is a small section of foreshore situated on an alluvial fan south of Carpenter Creek and adjacent to the Kohan Reflection Garden. It is a flat, south facing site which is

exposed to strong winds off of the Slocan Lake. This treatment area is situated at 545 m elevation. It is also classified under the BEC system as ICH dw 01a. The site is characterized as a shallow bay bordered (at low water) by a beach composed of cobble. It is mostly under the high water mark and so the vegetation must be tolerant of seasonal fluctuations in the water level.

The site is bounded by the Kohan Reflection Gardens on the north side, residences on the east side and an RV park on the west side. It is used by the public on a daily basis and is therefore subject to public safety concerns. During the summer of 2009 a wind storm blew down several black cottonwoods which damaged an RV and created a major public safety concern for Village of New Denver staff. Subsequent to this event the Village of New Denver had more black cottonwoods removed and there has been some erosion in the foreshore area.

There are invasive plants populating the foreshore including (but not limited to) curled dock *(Rumex crispus),* chickory *(Cichorium intybus) and s*potted knapweed *(Centaurea spp.).* While this infestation is currently relatively small, it represents a seed source of invasive plants that threaten the integrity of surrounding foreshore areas.

Figure 4: Kohan Reflection Garden treatment area facing east, May 2011

Figure 5: Kohan Reflection Garden treatment area at full pool, June 2011

Figure 6: Reference ecosystem site, Roseberry BC

3.2 Considerations for Working around Water

The Kohan Reflection Garden treatment area is largely foreshore. Foreshore is defined as the area located between the low and the high water mark. As such, persons implementing this ERP must be mindful of providing notifications to the Department of Fisheries and Oceans and the BC Ministry of Environment in regards to working around water. At a minimum, a notification should be sent to the Department of Fisheries and Oceans informing them that work will be done on a public beach and that the conditions listed in the Operational Statement for Maintenance of a Public Beach will be observed. This Operational Statement can be found at the following url: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/beach-plages-eng.htm.

In order to practice due diligence, the Village of New Denver should also contact Virginia Stanford a call at the BC Ministry Of Environment (250 354-6340) to discuss whether notification for a Section 9 under the Water Act should be provided. This project falls into a grey area under the types of work requiring notification so personal contact with MOE staff is recommended. The Water Act notification form can be found at the following
url: http://www.env.gov.bc.ca/wsd/water_rights/licence_application/section9/application.pdf.

3.3 Ecological Values

The shrub mix of Saskatoon berry, nootka rose, willow and red osier dogwood on the treatment area provides excellent habitat for song birds and small mammals. There is a beautiful mix of these species on the site's eastern-most boundary. Water fowl such as eared grebes *(Podiceps nigricollis),* common mergansers *(Mergus merganser)* and mallard ducks (Anas platyrhynchos) have been observed using the area. North American river otter (*Lontra canadensis*) have also been seen using the area.

3.4 Social Values

The Kohan Reflection Garden site is used by the public on a daily basis. The residents of New Denver are very proud of the Gardens and cherish their value as a place to enjoy the natural and cultural beauty of their community. As a result, any restoration efforts made on the foreshore should work towards achieving the combined goals of protecting wildlife habitat, the integrity of surrounding foreshore areas, public safety and the aesthetic value of the site.

3.5 Background Ecological Data

The Kohan Reflection Garden site is classified as ICH dw 01a. However, the site's proximity to Slocan Lake situates it in the riparian ecotone, which causes the plant list to differ slightly from those recommended for Bellevue St.

A reference ecosystem was used in conjunction with the BEC system to generate a list of recommended plants for this treatment area. The reference site (located in Roseberry BC) is situated on an alluvial fan 5 km NW of the Kohan Reflection Gardens. The elevation on the reference site is 550m. The aspect is slightly more west facing than that at the Kohan Reflection Garden. The reference site is flat and composed of a healthy mix of native vegetation. Dominant shrub species include Saskatoon berry *(Amelanchier alnifolia),* Nootka rose *(rosa nutkana),* Red osier dogwood (*cornus stolonifera),* Willow *(salix spp.),* soopolallie *(Sheperdia Canadensis),*sitka alder *(Alnus crispa),* common snowberry

(Symphoricarpos albus) and Douglas maple *(Acer glabrum).* A mix of tree species consistent with the vegetation tables for ICH dw 01a were present, but were disregarded in the inventory as the Village of New Denver is not interested in planting trees on the Kohan Reflection Gardens treatment area due to public safety concerns.

3.6 Treatment Goals for Kohan Reflection Garden Treatment Area

1. Remove a source population of invasive weeds thereby protecting the integrity of surrounding shoreline.

2. Improve habitat for songbirds, small mammals and waterfowl.

3. Prevent erosion where shoreline has been damaged by windstorm blow-downs and tree removal.

4. Provide public education regarding riparian ecosystems and their importance to ecological diversity and water quality.

3.7 Treatment Objectives for Kohan Reflection Garden Treatment Area

1.1 Hand pull invasive weeds on the foreshore area and replace with native riparian shrub species. The presence of shrub species will shade out seedlings generated by the seed bank left behind by invasive weeds.

2.1 Plant a mix of shrubs listed in Table 2 in a way that provides connectivity to the healthy, native edge of shrubs already present on the east side of the site.

3.1 Pocket plant stones on the west side of the site with shrubs listed on Table 2.

3.2 Seed bare mineral soil in eroded areas with Teck Riverside Reclamation seed mix (available through Quality Seeds West, Langley BC) to outcompete invasive weed seeds. This seed mix was developed for riparian restoration projects in the BC Southern Interior, specifically the West Kootenays.

4. Place an interpretive sign on near the foreshore which provides information regarding the importance of riparian ecosystem health. Interpretive signs are supported by New Denver's Official Community Plan and this would be an ideal location for such a sign (Village of New Denver 2007).

Table 4:List of recommended shrubs for the Kohan Reflection Garden foreshore.

Shrubs	**Recommended Number of Plants**
Saskatoon berry *(Amelanchier alnifolia)*	10
Nootka rose *(rosa nutkana)*	15
Red osier dogwood (*cornus stolonifera)*	10
Willow *(salix spp.)*	10

3.9 Estimated Costs for Kohan Reflection Gardens

Table 5: Estimated Costs Kohan Reflection Gardens

Material	Quantity	Unit price	Shipping	Estimated Cost (Including HST)
Plants	45 plants in 1 gallon pots	$16.00	$100.00	$918.40
Seed	1 20 kg bag Eco Green Interior Revegetation mix.	$97.00	$28.00	$119.84
Soil	6 yards	$35.00	included	$235.20
Gaia organic fertilizer (4-4-4)	1 bag	$59.95	n/a	$67.14
Peat moss	3 bales	$24.00	n/a	$80.64
Rock	8 m^3	$50.00/$m^3$	$300.00	$784.00
Labour	20 hrs	$12.00	n/a	$268.80
			Total	**$2474.02**

4. Monitoring and Maintenance

The success of a restoration project can only be measured by a well implemented monitoring program. As a community project, this restoration work is made possible largely due to the efforts of volunteers and in kind labor donations from the Village of New Denver. Therefore, funding for maintenance and monitoring is limited. However, a monitoring program is necessary to determine if the restoration objectives have been met, to protect the site from further vandalism and to guide future restoration efforts. Maintenance (watering) will also be required during the first growing season to ensure that plants survive and have the opportunity to establish strong root systems. This project is composed of small treatment units enabling data to be collected directly in a qualitative manner that does not require statistical sampling. The following monitoring and maintenance activities are recommended for this restoration project.

Year 1

Routine evaluation of the plants can be done in conjunction with maintenance activities during the first growing season. In order to facilitate monitoring and maintenance, trees and shrubs will be planted in groups of 5. This will result in 16 groups of 5 plants each. A 10' galvanized nail complete with washers, identification tags and flagging tape will be placed in the center of each group. These nails will mark the plot centers. A Global Position System (GPS) will be used to identify the coordinates for each plot center. The plots will be 16 m^2 in size. When the plots are planted, crews will sketch the layout of the plantings

(with the assistance of an Environmental Technician) noting the position and species of plants within the plots.

Volunteers from the community will be assigned a group (or groups) of plants that they will be responsible for watering and checking on. Forms will be administered to the volunteers whereby they can enter information about the survival status of their plants at each check. The form should be kept simple so that volunteers with limited botanical knowledge can complete the records without confusion or frustration. Appendix 2 shows a sample form that could be used to monitor plant survival. At the end of the season the forms will be collected and the data entered into a spreadsheet.

Year 2

During the second season, volunteers will continue walking through the restoration site on a bi-monthly basis during the growing season to perform the routine evaluations. By this time, maintenance activities should no longer be required. At the end of the second season, an Environmental Technician will revisit the plots with the original sketches and note the condition of each plant, recreating the sketches for comparison.

Year 3

At the end of the third season, an Environmental Technician will repeat the process of checking on the plots and re-sketching them. The Technician will then submit a short report summarizing the plot sketches cross-referenced with the spreadsheet data which will quantify the survival of the planted material and make recommendations for future restoration efforts. It is recommended that a bird survey also be performed during the third season to determine if the restoration objective of restoring habitat for songbirds has been met.

5. References

British Columbia. 1998. Field Manual for Describing Terrestrial Ecosystems. BC Ministry of Environment Lands and Parks - Research Branch. http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh25.htm.

Columbia River Basin Biodiversity Atlas. 2010. Fish and Wildlife Compensation Program, Columbia Basin in partnership with Selkirk College. http://www.sgrc.selkirk.ca/imf5_2/imf.jsp?site=bioatlas_n.

MacKillop, Deb. 2011. Research Ecologist [BC Ministry of Forests, Lands and Natural Resources] Personal Communication.

Village of New Denver. 2007. Official Community Plan Bylaw No 611.

Appendix 1: Map of Treatment Areas

Appendix 2: Proposed Monitoring Form

Plot #	Date	#Live Plants	#Dead Plants	Observed bird and wildlife use	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Appendix 3: Example of Proposed Plot Sketch Design