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Baseline Ecological Assessment
Bright Angel Park

for:

Graham Gidden, Parks and Trails Planner
Parks and Trails Division
Parks, Recreation and Culture
Cowichan Valley Regional District

by:

Trystan Willmott, B.Sc., A.Sc.T.
MADRONE ENVIRONMENTAL SERVICES LTD.
1081 Canada Avenue, Duncan, BC, V9L 1V2

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1.0 INTRODUCTION

Based on the significant public use of Bright Angel Park, which is managed by the Cowichan Valley Regional District (CVRD), the client (CVRD) are proceeding with the rejuvenation of several existing amenities in the park. The rejuvenation of amenities is necessary in order to allow the CVRD to manage the park effectively. Prior to the completion of the upgrades, Madrone Environmental Services Ltd. (Madrone) were requested to carry out a baseline Ecological Assessment (EA) to identify potential sensitive habitat attributes on site and in surrounding areas.

1.1 Objectives

The main objective of the EA was to determine the baseline attributes of the study area regarding vegetation, fisheries and wildlife values and determine potential impacts associated with the proposed upgrades. With an understanding of site level ecological features, the client will be able to plan the proposed upgrades to the park accordingly. The client will also be able to use recommendations made as part of the EA in the preparation of a longer term management plan for Bright Angel Park.

Where appropriate, mitigation measures specific to the proposed upgrades and habitat conditions were developed to ensure that any potential impacts would be negated. Due to the time of year that the fieldwork was carried out, the assessment does not represent an exhaustive list of vegetation or wildlife using the study area.

Rather, the assessment provides information on habitat attributes and the potential of the study area to support rare species and discusses potential impacts.

1.2 Study Area

The study area represents the Bright Angel Park property located to the south of Duncan near Cowichan Station. The facility is accessed via Tigwell Road, which intersects with Koksilah Road (Figure 1).

Bright Angel Park provides day use facilitates in the form of a parking area, hiking trails, a playground, picnic shelters and pit toilets. A suspension bridge across the Koksilah River, which flows through the park, provides access for foot traffic, connecting a network of trails on the western (upland) portion of the park to a riverside trail on the eastern side of the river.

1.3 Overview of Proposed Upgrades

Based on the significant public use of Bright Angel Park, the CVRD are concerned that the current aging infrastructure is insufficient to support the existing (and growing) demand. Various upgrades are proposed to replace existing amenities, including: a new change room, which will consist of showers, toilets and changing areas; a new outdoor fitness area, with a variety of stations; an upgraded children's playground; an updated multi-use playing field (including a volleyball court); upgraded trail surfaces (main high-use trails only); new seasonal access trail to the western side of the river for dogs, with the potential to create a trail loop; and the extension of an existing trail on the eastern side of the river to create a loop. The majority of upgrades will focus on existing public use areas of the park, although the proposed trail additions would enter into new areas.

The location options under consideration for the new public washroom building include the lower parking area, upper playing field and existing location of the playground. Location options for the children's playground are the existing playground site, the lower parking area and the upper playing field. The options for the location of the outdoor fitness circuit equipment are the existing playground site, lower parking area, upper playing field and along the fitness trail. All these location options are beyond the riparian influence of the Koksilah River and occur over existing park use areas.

Currently, there is public access to the eastern side of the Koksilah River. Based on the constricted nature of the accessible area, the CVRD field numerous complaints related to conflicts between members of the public. The main source of conflict occurs between dog owners and non-dog owners. In response to the public concern and to relieve pressure on the accessible area, the CVRD is considering the implementation of seasonal restrictions that would prevent dog access to the eastern side of the river during the summer months. Summer-time access to the river for dogs could be redirected via a newly created trail to a gravel bar located close to the south-eastern property boundary.

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FIGURE 1: Overview Location Map

2.0 PRE-FIELD RESEARCH

2.1 Wildlife

In order to check for documented occurrences of nests (e.g. raptors) in proximity to the study area, the Wildlife Tree Stewardship (WiTS) Atlas (http://squamish2010.ca/mapguide2010/wits/main.php) was accessed. This web-based tool provides mapped known locations of nest sites, but does not represent an exhaustive list of all nests. Ground-based surveys provide a more appropriate level of detail for determining the existence of nests in a study area.

Prior to the field visit, a list of potential federal Species at Risk (SAR) and provincially red-listed and blue-listed wildlife species was determined by querying the British Columbia Conservation Data Centre (B.C. CDC, 2012). The CDC is a branch of the B.C. Ministry of Environment. The focal list, specific to the study area, was compiled based on known distributions and habitat requirements of individual species. The CDC database was also used to check for mapped known locations of listed wildlife species.

2.2 Species Status Ranking Systems

2.2.1 Provincial Ranking System

Within B.C., the CDC is responsible for assigning provincial status of indigenous species. The coding is by colour, with red indicating species at greatest risk (threatened and endangered species), blue representing species of special concern, and yellow indicating the lowest level of risk (Table 1).

Table 1. Provincial Ranking System and Definitions

Rank	Description
Yellow List	Indigenous species and subspecies deemed not to currently be at risk in B.C.
Blue List	Indigenous species and subspecies of special concern in B.C.
Red List	Indigenous species and subspecies that are extirpated, endangered, or threatened in B.C. These species either have, or are candidates for, official extirpated, endangered, or threatened status in B.C.

Four provincially red-listed wildlife species with the **potential** to occur in the area include: Western Painted Turtle – Pacific coast population (*Chrysemys picta*), Northern Goshawk *laingi* subspecies (*Accipiter gentilis laingi*), Keen's Long-eared Myotis (*Myotis keenii*) and American Water Shrew, *brooksi* subspecies (*Sorex palustris brooksi*).

Blue-listed wildlife species selected as focal species that have the potential to occur on site include: Band-tailed Pigeon (*Patagioenas fasciata*), Northern Pygmy-owl (*Glaucidium gnoma swarthi*), Western Screech-owl *kennicottii* subspecies (*Megascops kennicottii kennicottii*), Great Blue Heron, *fannini* subspecies (*Ardea herodias fannini*), Marbled Murrelet (*Brachyramphus marmoratus*), Green Heron (*Butorides virescens*), Olive-sided Flycatcher (*Contopus cooperi*), Townsend's Big-eared Bat (*Corynorhinus townsendii*), Roosevelt Elk (*Cervus elaphus roosevelti*), Western Toad (*Anaxyrus boreas*), Northern Red-legged Frog (*Rana aurora*), Moss's Elfin (*Callophrys mossii mossii*) and Dun Skipper (*Euphyes vestris*). The site was also assessed to determine if there was suitable habitat for the following yellow-listed species: Bald Eagle (*Haliaeetus leucocephalus*), Black Bear (*Ursus americanus*) and Columbian Black-tailed Deer (*Odoicoileus hemionus columbianus*).

2.2.2 Federal Ranking System

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the status of wild species in Canada. The application of ranking criteria by COSEWIC describes the relative condition of a particular species and gives some indication as to the likelihood of extinction. For example, a species that is **"Endangered"** faces imminent extirpation or extinction; a species that is **"Threatened"** is likely to become endangered if limiting factors are not reversed (Table 2).

The Species at Risk Act (SARA) is federal legislation that aims to prevent endangered or threatened species from becoming extinct, help in the recovery of rare species and manage species of special concern. Species listed on Schedule 1 represent the official list of wildlife species at risk.

Table 2. Federal Species at Risk and Ranking Definitions

Rank	Description
X – Extinct	Species no longer exists.
XT - Extirpated	Species no longer exists in Canada, but it still occurs elsewhere.
E - Endangered	Species is facing imminent extirpation or extinction.
T - Threatened	Species is likely to become endangered if limiting factors are not reversed
SC - Special Concern	Species that are sensitive to human activities and natural events, but are not considered Endangered or Threatened.
DD - Data Deficient	Species with inadequate information to make direct or indirect assessment.
NAR - Not at Risk	Species that have been evaluated, but are considered not at risk.

Table 3 summarizes the provincial and federal ranking status for each of the focal species identified for the study area.

Table 3. Focal Species Ranking Summary

Species	Provincial Rank	Federal Rank	Species at Risk Act Status
Northern Goshawk *laingi* subspecies	Red	Threatened	Threatened – Schedule 1
Keen's Long-eared Myotis	Red	Data Deficient	N/A
American Water Shrew	Red	N/A	N/A
Western Painted Turtle (Pacific Coast Population)	Red	Endangered	Endangered – Schedule 1
Olive-Sided Flycatcher	Blue	Threatened	Threatened – Schedule 1
Marbled Murrelet	Blue	Threatened	Threatened – Schedule 1
Green Heron	Blue	N/A	N/A
Band-tailed Pigeon	Blue	Special Concern	Special Concern – Schedule 1
Northern Pygmy-owl	Blue	N/A	N/A
Western Screech-owl *kennicottii* subspecies	Blue	Special Concern	Special Concern – Schedule 1
Great Blue Heron	Blue	Special Concern	Special Concern – Schedule 1
Townsend's Big-eared Bat	Blue	N/A	N/A
Roosevelt Elk	Blue	N/A	N/A
Northern Red-legged Frog	Blue	Special Concern	Special Concern – Schedule 1
Western Toad	Blue	Special Concern	Special Concern – Schedule 1
Dun Skipper	Blue	Threatened	Threatened – Schedule 1
Moss's Elfin	Blue	N/A	N/A
Bald Eagle	Yellow	Not at Risk	N/A
Black Bear	Yellow	Not at Risk	N/A
Columbian Black-tailed Deer	Yellow	Not at Risk	N/A

2.3 Sensitive Ecosystem Inventory and Rare Ecosystems

In 1997, the Sensitive Ecosystem Inventory (SEI) was completed for the East Coast of Vancouver Island (including the southern Gulf Islands) by a Technical Advisory Group. The group consisted of representatives from Environment Canada (EC), the Canadian Wildlife Service (CWS), the Ministry of Environment (MoE), the Ministry of Sustainable Resource Management (MSRM), and the Conservation Data Centre (CDC) (Ward *et al.*, 1998).

"An ecosystem is defined as a portion of landscape with relatively uniform dominant vegetation; a sensitive ecosystem is one that is fragile and/or rare"

(CDC, 2012). Sensitive ecosystems are particularly valuable in that they provide critical habitat for species at risk, they contain a high level of biodiversity, and also form wildlife corridors and linkages.

The main objectives of the SEI mapping were to identify remnants of rare and fragile terrestrial ecosystems, and encourage appropriate management techniques that take into account the fragility of the specific ecosystems. The East Coast of Vancouver Island and the southern Gulf Islands are of particular significance when considering the threats to sensitive ecosystems, due to development pressures associated with a growing population.

The SEI recognizes seven specific sensitive ecosystems, which are:

- Wetlands (WN)
- Riparian areas (RI)
- Old forest (OF)
- Woodland (WD)
- Terrestrial herbaceous (HT)
- Coastal bluff (CB)
- Sparsely Vegetated (SV)

Two additional modified sensitive ecosystem types are also included: seasonally flooded agricultural fields and older second growth forest. Mapping occurred on imagery ranging in scales from 1:10,000 to 1:20,000.

The SEI map resource:
(http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=2124)
was used to identify the occurrence of any known sensitive ecosystems in the study area. A search for documented rare ecosystems was also carried out using the web-based CDC search mechanism (B.C. CDC, 2012).

2.4 Fish and Fish Habitat

To help determine potential fish distribution and drainage patterns on site, the Habitat Wizard website:

(http://webmaps.gov.bc.ca/imf5/imf.jsp?site=moe_habwiz) was accessed. Potential fish observation points for the study area and connected water-bodies were queried using the Fisheries Information Summary System (FISS) (http://a100.gov.bc.ca/pub/fidq/fishDistributionsQuery.do).

While this type of database research is useful in determining the general drainage network, it does not represent an exhaustive list of watercourses in a given area. Ground-based fieldwork is the most appropriate method of obtaining an accurate representation of watercourses in a study area.

3.0 FIELD ASSESSMENT METHODOLOGY

The assessment area was traversed on foot by Trystan Willmott, B.Sc., A.Sc.T., and Jennifer Morgen, M.Sc., B.I.T. on October 30th 2012 to determine the various habitat types and assess habitat suitability for focal species. Field notes were taken to describe the general site attributes, while individual assessment plots were completed to capture detailed site characteristics. During the field assessment, more focus was given to areas of new development (e.g. footprint of the new dog access trail to the river), with a more general approach used for the remaining area. The following habitat and site variables were recorded at each plot:

- UTM coordinates.
- Slope.
- Aspect.
- Elevation.
- Average tree dbh (cm) and range of girth by species.
- Average canopy height (m).
- Percent Canopy closure.
- Vegetation identification and percent cover (shrub, herb and moss layers).
- Presence of coarse woody debris (CWD) and wildlife trees.
- Tree species composition.
- Landscape factors.
- Evidence of wildlife use.

- Habitat suitability for red-and blue-listed species.
- Disturbance history.
- Representative habitat photographs.
- Site condition.

The study area was further divided into areas of similar vegetation assemblage polygons. Plants were identified according to Pojar and MacKinnon (1994).

A rating of 1 to 6, as per the RISC standards for Capability/Suitability habitat mapping (RISC, 1999), was recorded at each plot for red and blue-listed species that have the potential to occur in the area (the focal species). Areas with high habitat suitability were given a rating of 1 and those with no habitat suitability were given a rating of 6. Only current habitat suitability was assessed for the focal species listed in Table 3. General observations were also made of wildlife sign (e.g. tracks and trails). Representative site photos were taken during the field assessment (Appendix I). Un-mapped watercourses on site were followed to assess habitat attributes and check for connected downstream values.

4.0 RESULTS

4.1 General Site Description

Background mapping indicates the study area is located in the mapped extent of the Coastal Douglas-Fir moist maritime (CDFmm) Biogeoclimatic Zone. Warm, dry summers and mild, wet winters characterize the CDFmm as it lies in the rainshadow of Vancouver Island and the Olympic Mountains. The CDFmm is restricted to low elevations that range from sea level to approximately 150 m.

Only a small proportion of the land mass of BC lies within the CDFmm; however, these are the most densely populated areas of the province. Conditions are such that residential, agricultural, commercial and industrial developers are attracted to the region. The ecosystem and climatic conditions that characterize the CDFmm extend from southeast Vancouver Island and continue south through Puget Sound.

The extent and condition of naturally-occurring ecosystems and wildlife have been directly impacted by anthropogenic disturbances such as logging, agriculture, introduction of invasive species, land alienation, resource extraction,

altered drainage patterns, urban sprawl, and fire suppression. Numerous ecosystems in the CDFmm are provincially red-listed, due to the historical land use pressures that have resulted in the loss of these sites.

Beyond the existing park facilities and parking area, the majority of the land base at Bright Angel Park supports forested ecosystems, with the most common tree species consisting of western redcedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*) and Douglas-fir (*Pseudotsuga menziesii*). Black cottonwood (*Populus balsamifera trichocarpa*) is abundant in moister areas. Grand fir (*Abies grandis*) is also common, especially along the riparian area adjacent to the eastern side of the river. Pacific yew (*Taxus brevifolia*) are scattered throughout the forested areas, but appear to be more common in the riparian area along the eastern side of the river. Western hemlock (*Tsuga heterophylla*) is relatively common throughout the park, suggesting that the local site conditions are more closely associated with the Coastal Western Hemlock very dry maritime (CWH xm) Biogeoclimatic Zone, despite being well within the mapped range of the CDFmm zone. The riparian forest adjacent to the eastern side of the Koksilah River contains numerous veteran trees, with Douglas-fir and western redcedar in excess of 2 m dbh. Grand fir veterans also occur in this forested area.

The Koksilah River flows from south to north through the park, and represents a significant habitat feature. Notwithstanding the importance of the river from a fishery resource perspective, the riparian corridor will provide important habitat for wildlife. Ungulates (e.g. Columbian Black-tailed Deer and Roosevelt Elk) will use the corridor for forage, security and travel, as will carnivores (e.g. Black Bear).

4.2 Background Research

4.2.1 Sensitive Ecosystems and Listed Rare Ecosystems

As part of the SEI, four mapped sensitive ecosystems occur within the park boundaries. These are SEI Polygons V0436, V0437, VO438, and VO471 (Figure 2). Polygons V0436, 437, and 471 are riparian ecosystems (coded RI), where-as Polygon V0438 is labeled as a wetland (marsh). The appearance of the open area labeled as Polygon V0438 on the orthophotograph suggests a wetland ecosystem, but during the field assessment, we noted that this area is not a wetland, but consists of an elevated opening with dense shrub vegetation (no hydrophytes or organic soils occur).

The riparian ecosystems identified as part of the SEI adjacent to the Koksilah River indicate the value of these habitat types. V0436 represents the mature riparian forest on the eastern side of the river containing veteran fir and redcedar, where-as Polygons V0437 and V0471 consist of the treed active floodplain area located in the northern portion of the park.

4.2.2 Wildlife

Background research using the CDC database returned two documented occurrences of listed species within close proximity to the study area: the Dun Skipper and Moss's Elfin (both provincially blue-listed butterflies). The record for Moss's Elfin is associated with an observation along the railway corridor adjacent to the eastern side of the park in 1994. The Dun Skipper record was also from the railway corridor, but from an area near Cowichan Station (approximately 1 km south of the park) in 1996.

A search of the WiTS database returned a documented Bald Eagle nest in the Koksilah River corridor approximately 600 m to the south of the study area. A Great Blue Heron colony is documented as occurring approximately 1200 m to the south east of the study area.

The known distribution of significant features (sensitive ecosystems and nest sites) is indicated on Figure 2 in context with the study area boundaries. No provincially-listed ecosystem types were noted as a result of the background research.

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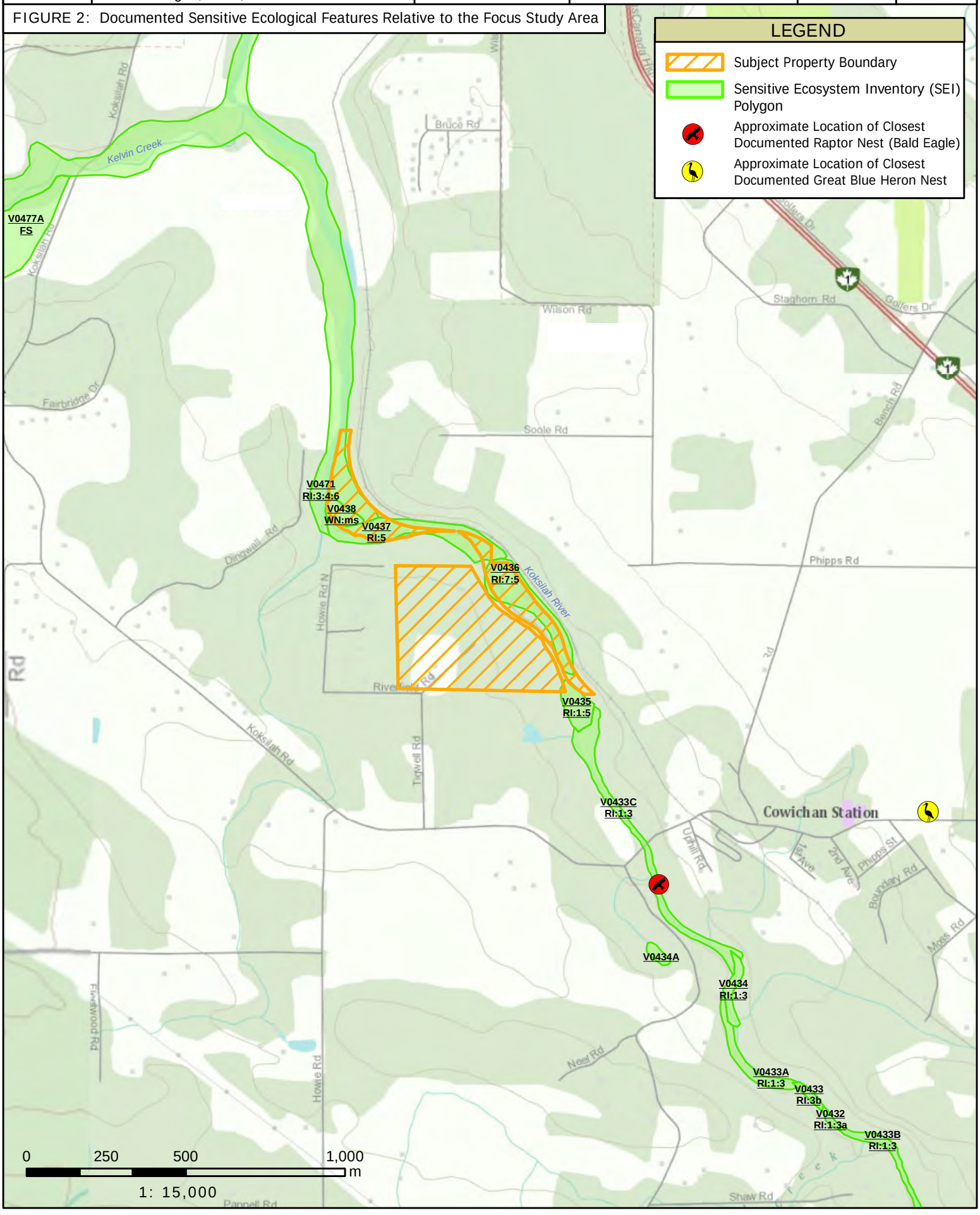
FIGURE 2: Documented Sensitive Ecological Features Relative to the Focus Study Area



4.2.3 Documented Fish Habitat

Apart from the Koksilah River, background research using Habitat Wizard and FISS returned no other known watercourses within the study area boundaries. The Koksilah River (watershed code 920-257700-02300) is a fourth order stream that is known to support populations of chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O.keta*), winter-run steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarkii clarkii*) – including anadromous form, and rainbow trout (*O. mykiss*).

4.3 Description of Vegetation Assemblages

The study area was split into four broad vegetation assemblage types, as per Figure 3 (Polygons 1 – 4).

Polygon 1

This polygon consists of the mature riparian forest along the right bank (eastern side) of the Koksilah River. The topography is flat along the immediate edge of the river, with moderate slopes rising up to the edge of the park boundary at the railway corridor. An existing trail runs through the riparian zone close to the river's edge. This area has been identified by the SEI as Polygon V0436, a "Riparian" sensitive ecosystem type.

The tree layer is comprised mainly of western redcedar, grand fir and bigleaf maple. Western hemlock, along with Pacific yew (in the understory) are also scattered through this polygon. Isolated occurrences of cascara (*Rhamnus purshiana*) were also observed. The average tree height is approximately 20 m, although veteran Douglas-fir in this area likely exceed a height of 40 m. Average Diameter at Breast Height (DBH) is approximately 60 cm, with veteran Douglas-fir and western redcedar exhibiting diameters up to 2 m. The canopy closure is up to 60%. Stand characteristics are typical of a mature forest (structural stage 6), with scattered occurrences of very old trees that have persisted through previous disturbances (refer to Appendix II for definitions of structural stages).

The most common shrub species include salal (*Gaultheria shallon*) and dull Oregon-grape (*Mahonia nervosa*). Red huckleberry (*Vaccinium parvifolium*) also occurs. In moister areas, such as in and around the seepage area in the northern portion of the polygon, salmonberry (*Rubus spectabilis*) and red elderberry (*Sambucus racemosa*) are common. Due to the time of year, the herb layer was

sparse during the assessment, but species distribution was generally indicative of a nutrient rich site. The most common species were sword fern (*Polystichum munitum*), foamflower (*Tiarella trifoliata*), false solomon's seal (*Smilacina racemosa*) and clasping twisted stalk (*Streptopus amplexifolius*). Twinflower (*Linnaea borealis*), wall lettuce (*Lactuca muralis*) and trailing blackberry (*Rubus ursinus*) were also observed. In wetter areas, skunk cabbage (*Lysichiton americanum*), slough sedge (*Carex obnupta*) and maidenhair fern (*Adiantum pedatum*) also occurred. Oregon-beaked moss (*Eurhynchium oreganum*), slender beaked moss (*Kindbergia praelonga*) and coastal leafy moss (*Plagiomnium insigne*) were the most common species in the moss layer.

Polygon 2

This vegetation assemblage represents the low-lying area located between the base of the steep slope running parallel to the edge of Polygon 3 and the left bank of the Koksilah River. No recent evidence of flooding, such as flood-rafted debris, fluvial sediments, channels free of terrestrial vegetation, or trees scarred by flood material, were noted in this area. The lack of flooding evidence suggests this polygon is an inactive floodplain, but flood water from the river may still enter this area during very occasional extreme high flow events (e.g. 1 in 200 year return period).

Based on the topography and collection of moisture received from the slope to the west, the vegetation assemblage in Polygon 2 reflects a moist site. The tree layer consists mainly of black cottonwood, red alder (*Alnus rubra*) and bigleaf maple. The average tree height is 20 m, with some of the larger black cottonwoods reaching heights of 30 m. Average DBH is approximately 40 cm, but the more mature black cottonwood trees exhibit diameters up to 70 cm. The canopy is relatively open at 35%.

The southern portion of the polygon supports dense shrub coverage, with salmonberry, Indian plum (*Oemleria cerasiformis*), red elderberry (*Sambucus racemosa*), Pacific ninebark (*Physocarpus capitatus*), Nootka rose (*Rosa nutkana*), thimbleberry (*Rubus parviflorus*) and snowberry (*Symphoricarpos albus*) occurring. Red osier dogwood (*Cornus stolinifera*) and Douglas maple (*Acer glabrum*) also occur infrequently. The northern portion of the polygon is open, with extensive areas of reed canary grass (*Phalaris arundinacea*) and pockets of Himalayan blackberry (*Rubus discolor*) and European blackberry (*Rubus laciniatus*) – both invasive species. Willow (*Salix* sp.) is also scattered throughout the more open areas.

In addition to the invasive blackberry, other invasive and/or introduced species occur throughout this polygon, including Japanese knotweed (*Fallopia japonica*), Canada thistle (*Cirsium arvense*), perennial peavine (*Lathyrus latifolius*), common burdock (*Arctium minus*) and Himalayan balsam (*Impatiens glandulifera*).

Due to the time of year the assessment was completed, the herb layer was sparse. The most common herb species observed included reed canary grass (restricted to the open area in the northern portion of the polygon), palmate coltsfoot (*Petasites palmatus*) and cooley's hedge nettle (*Stachys cooleyae*). In moister depressions, common horsetail (*Equisetum arvense*) and lady fern (*Athyrium filix-femina*) also occurred. Lanky moss (*Rhytidiadelphus loreus*) and tree moss (*Climacium dendroides*) were the most common species in the moss layer.

Polygon 3

This forested ecosystem covers the majority of the study area and occurs to the west of the bottom of the slope running along the western boundary of Polygon 2. The topography is generally undulating, with moist micro-sites situated in depressions and slightly drier sites located on hummocks.

The tree layer is dominated by western redcedar and bigleaf maple, with grand fir and western hemlock scattered throughout. Douglas-fir is less common, occurring on drier sites only. The average tree height is approximately 20 m, with some of the larger western hemlock and grand fir being up to 30 m high. Average DBH is 30 cm, with diameters up to 80 cm for some of the more mature grand fir and western hemlock. The canopy is generally moderately closed throughout, with a canopy closure up to 60%. The forest stand characteristics are typical of a young forest (structural stage 5).

The shrub layer consists mainly of salal and dull Oregon-grape, with Indian plum, red huckleberry and snowberry scattered throughout. In moister depressions, such as the area surrounding the slough sedge wetland (assessment Plot 5 – Figure 3), salmonberry and red elderberry are common. The herb layer was sparse (due to the time of year), with sword fern, vanilla-leaf (*Achlys triphylla*), broad-leaved starflower (*Trientalis latifolia*) occurring throughout. In moister areas, such as adjacent to the slough sedge wetland, isolated pockets of skunk cabbage, lady fern and slough sedge also occurred. The moss layer consisted mainly of slender beaked moss, lanky moss and Oregon-beaked moss.

In addition to the more typical slough sedge wetland ecosystem containing hydrophytic vegetation and deep organic material, three seasonally inundated depressions were found in Polygon 3 (Figure 3). These areas hold water on a seasonal basis, some of which may persist in deeper pockets during the summer months, but lack hydrophytic vegetation. Isolated occurrences of water parsley (*Oementhe sarmentosa*) were observed, however, in the larger of the depressions. The depressions are influenced mainly by the collection of seasonal surface water as opposed to being influenced by fluctuations in the water table.

Polygon 4

This area represents the northern-most extension of Bright Angel Park. Seasonally active channels, alluvial deposits and flood-rafted debris occur throughout this polygon, indicating a broad active floodplain area. Young bigleaf maple and black cottonwood occur throughout the floodplain, but mainly on slightly elevated hummocks. As part of the SEI, "Riparian" ecosystems have been identified as occurring in this polygon (SEI Polygons V0437 and V0471).

The area identified by the SEI mapping layer as a marsh (Polygon V0438) actually occurs on relatively high ground above the main active floodplain and is not a wetland. The area is dry, and consists of dense shrub vegetation, with Nootka rose, snowberry and bracken fern (*Pteridium aquilinum*) occurring.

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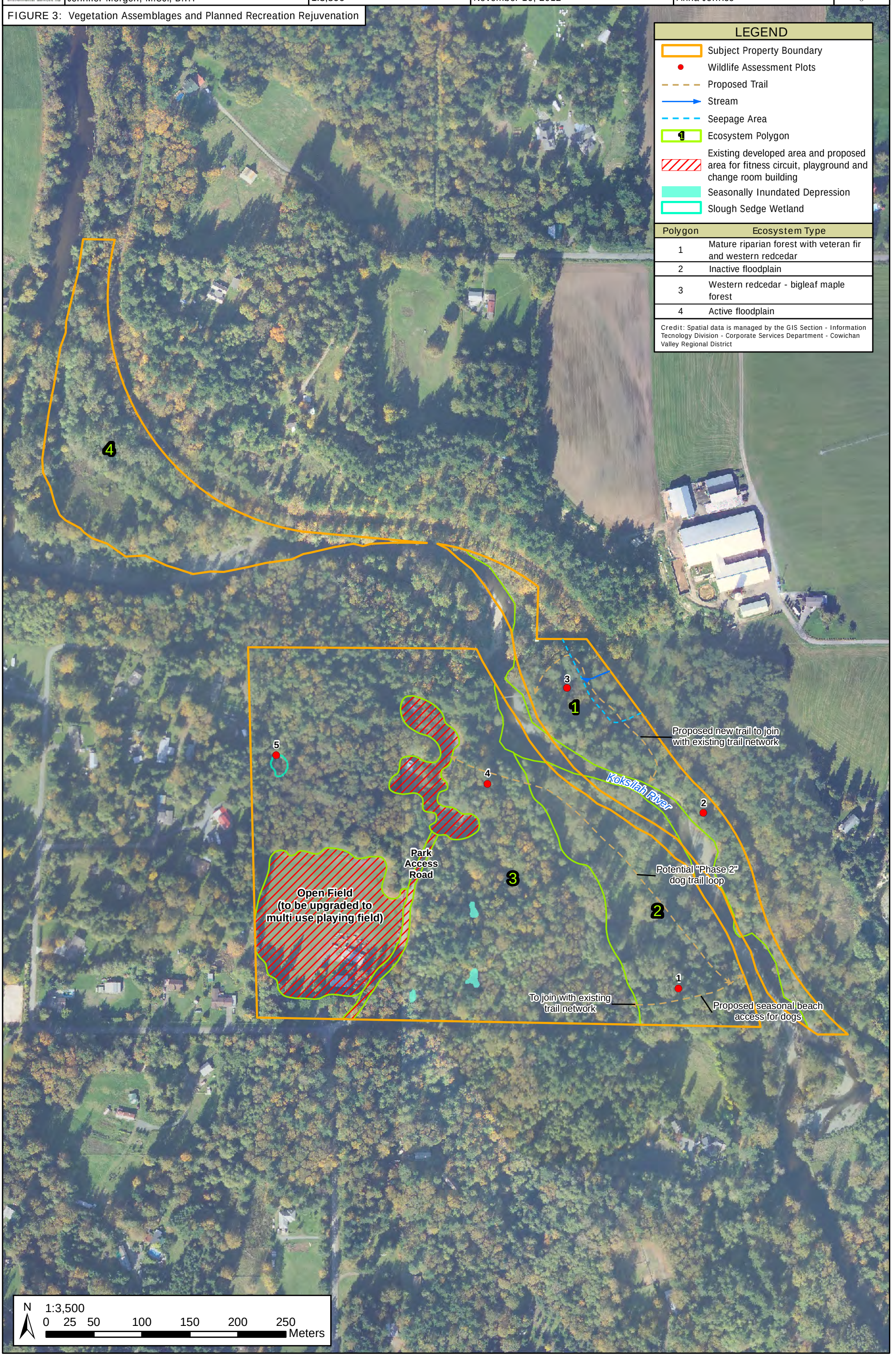
FIGURE 3: Vegetation Assemblages and Planned Recreation Rejuvenation



4.4 Wildlife Habitat Potential

4.4.1 Habitat Suitability for Focal Species

Habitat suitability on the subject property was assessed for four red-listed, 13 blue-listed and three yellow-listed high profile wildlife species. Table 4 summarizes habitat values for the focal wildlife species assessed within the study area. Refer to Appendix III for summary species accounts.

Table 4. Summary of Current Wildlife Habitat Values – Bright Angel Park

Species	Habitat Suitability Rating (RISC, 1999)				
	Wildlife Assessment Plot 1 – inactive floodplain (Polygon 2)	Wildlife Assessment Plot 2 – mature riparian forest (Polygon 1)	Wildlife Assessment Plot 3 – mature riparian forest (Polygon 1)	Wildlife Assessment Plot 4 – western redcedar – bigleaf maple forest (Polygon 3)	Wildlife Assessment Plot 5 – western redcedar – bigleaf maple forest (Polygon 3)
Northern Goshawk – nesting habitat	**5**	**3**	**3**	**4**	**4**
Keen's Long-eared Myotis – roosting habitat	**4**	**2**	**2**	**3**	**3**
American Water Shrew, *brooksi* subspecies – breeding habitat	**3**	**3**	**3**	**5**	**5**
Western Painted Turtle – Pacific Coast Population – breeding habitat	**4**	**4**	**4**	**6**	**6**
Olive-sided Flycatcher – nesting habitat	**3**	**2**	**2**	**3**	**3**
Marbled Murrelet – nesting habitat	**5**	**4**	**4**	**5**	**5**
Green heron – nesting habitat	**2**	**3**	**3**	**4**	**4**
Band-Tailed Pigeon – nesting habitat	**3**	**3**	**3**	**3**	**3**
Northern Pygmy Owl – nesting habitat	**3**	**3**	**2**	**3**	**3**
Western Screech Owl – nesting habitat	**3**	**2**	**2**	**2**	**2**
Great Blue Heron (subspecies *fannini*) – nesting habitat	**3**	**2**	**2**	**3**	**3**
Townsend's Big Eared Bat – roosting habitat	**4**	**2**	**2**	**3**	**3**
Roosevelt Elk - forage Habitat	**3**	**3**	**2**	**4**	**3**
Security habitat	**4**	**2**	**2**	**3**	**3**

Table 4. Summary of Current Wildlife Habitat Values – Bright Angel Park (continued)

Species	Habitat Suitability Rating (RISC, 1999)				
	Wildlife Assessment Plot 1 – inactive floodplain (Polygon 2)	Wildlife Assessment Plot 2 – mature riparian forest (Polygon 1)	Wildlife Assessment Plot 3 – mature riparian forest (Polygon 1)	Wildlife Assessment Plot 4 – western redcedar – bigleaf maple forest (Polygon 3)	Wildlife Assessment Plot 5 – western redcedar – bigleaf maple forest (Polygon 3)
Red Legged Frog - forage habitat	**2**	**2**	**2**	**2**	**2**
Breeding habitat	**6**	**6**	**6**	**6**	**5**
Western Toad - forage habitat	**2**	**2**	**2**	**2**	**2**
Breeding habitat	**6**	**6**	**6**	**6**	**5**
Dun Skipper – forage habitat	**4**	**4**	**3**	**4**	**3**
Moss's Elfin – forage habitat	**4**	**4**	**4**	**4**	**4**
Bald Eagle – nesting habitat	**4**	**2**	**2**	**4**	**4**
Black Bear – forage habitat	**1**	**2**	**2**	**4**	**3**
Denning habitat	**5**	**3**	**3**	**5**	**5**
Columbian Black-tailed deer – forage habitat	**2**	**3**	**3**	**3**	**2**
Security habitat	**3**	**2**	**2**	**3**	**3**

(1 indicates habitat of very high suitability, where-as 6 indicates nil suitability, as per RISC, 1999). Refer to Figure 3 for location of wildlife assessment plots.

The assessment area contains moderate to high habitat suitability for numerous focal species. The mature riparian forest (Polygon 1) supports veteran trees, which will provide nesting habitat for species such as western screech owls and northern pygmy owls. Natural cavities in these veteran trees, especially the western redcedars, will provide the most likely nesting habitat niches. Nesting habitat exists for large raptors such as Bald Eagles in the emergent veteran trees throughout Polygon 1, with excellent forage habitat available throughout the river corridor. Roosting habitat for bats could also exist in the veteran trees, with insect-rich foraging habitat occurring over the adjacent river.

The riparian habitat in Polygons 1 and 2 will provide excellent forage habitat for species such as Black Bears, especially in Polygon 2, with the abundance of berry-producing shrubs. These riparian areas are also adjacent to prime forage in the form of seasonally-abundant salmon in the Koksilah River. The mature forested

ecosystem in Polygon 1 will provide security habitat for large mammals such as Black Bears, Roosevelt Elk and Columbian black-tailed Deer. These species will use the riparian area as a travel corridor to meet their forage and security needs.

The edge habitat along the river and mosaic of vegetation types within the riparian corridor consisting of openings, mature forest and dense shrub thickets will support a diverse assemblage of nesting songbirds (including the Olive-sided Flycatcher – a focal species). Forage habitat for amphibians is abundant throughout the assessed area, due to the wide distribution of moist, shaded forested areas and occurrence of Coarse Woody Debris (CWD) throughout these habitats. The river and immediate riparian area will provide refuge habitat for amphibians during the dry summer months.

Breeding habitat for focal amphibian species is lacking, but the seasonally-inundated depressions may offer some potential (albeit limited). These isolated depressions likely do not contain enough water for long enough to allow the metamorphosis of larvae into juveniles (e.g. for Northern Red-legged frog and Western Toad). The depressions also lack emergent vegetation, which is often used as an attachment media for egg masses. The woody vegetation and periodicity of water in the seasonally-inundated depressions may be more suitable for species such as the Pacific chorus frog (*Pseudacris regilla*).

No specific habitat attributes were noted for the listed butterfly species, but their confirmed occurrence in proximity to the park is a significant factor. Based on the time that has passed since the observations of the Moss's Elfin and Dun Skipper (1994 and 1996 respectively), it is unclear whether these species still occur in the area. It is likely that the railway corridor supports a unique habitat niche that reflects the natural habitat preferences of these butterflies.

4.4.2 Wildlife Species and Wildlife Sign Detected

Due to the time of year during which the assessment was completed, only a limited number of birds were heard and/or observed during the assessment. Red-breasted Nuthatches (*Sitta canadanesis*), Pacific wrens (*Troglodytes troglodytes*), American Robins (*Turdus migratorius*) and Golden-crowned Kinglets (*Regulus satrapa*) were observed throughout the majority of the study area. A singular Common Raven (*Corvus corax*) flew over the study area and one Spotted Ttowhee (*Pipilo maculatus*) was observed close to the river in Polygon 2. A Northern Flicker (*Colaptes auratus*) was heard calling from one of the emergent

veteran trees in Polygon 1 and a small group of Canada Geese (*Branta canadensis*) flew over Polygon 2.

It should be noted that the bird species listed above do not represent an exhaustive account of all birds that are likely using the study area. During the spring/early summer breeding period, a range of bird species will use vegetated areas for nesting and foraging. Wildlife trees, with potential nesting cavities for cavity-nesting birds, were scattered throughout the area assessed.

Trails and pellets from Columbian black-tailed Deer (a focal species) were encountered throughout the study area, but most frequently in openings associated with Polygon 2. Defined fresh tracks from another focal species (Roosevelt elk) were observed in and around the moist seepage area located in Polygon 1, likely representing animals from the Dougan lake herd. A Northern red-legged frog (also a focal species) was observed in Polygon 2. An adult western toad (a focal species) was observed by the client in Bright Angel Park during the summer of 2012, further highlighting the value of the study area as forage habitat for native amphibians. Numerous Pacific chorus frogs were heard calling throughout the study area during the assessment. Beaver (*Castor canadensis*) sign in the form of old tooth marks on a bigleaf maple stump was also observed (Polygon 1).

Black bear scat (a focal species) was found along the railway corridor adjacent to the eastern park boundary. The content of the scat was typical for the time of year, consisting mainly of partially digested apples.

4.5 Fish Habitat

The Koksilah River represents an extremely important fishery resource value. Fish habitat attributes in the river where it flows through the study area are diverse. Spawning habitat in the form of riffle habitat units consisting of gravel alluvium is abundant. Deep pools are also present, providing rearing habitat for juveniles and resting areas for holding adult salmon and steelhead. Riparian vegetation is providing important biological functions in the form of shade, bank stability, nutrient input (litter fall), insect drop over fish habitat and provision of Large Woody Debris (LWD). The stream and seepage area identified during the assessment (Figure 3) do not represent fish habitat, but connect by surface flow to the Koksilah River.

Despite the time of year and suitable flow conditions during the assessment, the annual run of salmon (mainly chum salmon in the Koksilah system) had not begun. One migrating salmon was observed in the middle of the river from the suspension bridge, but no salmon were observed on redds (*i.e.*, no fish were observed actively spawning in suitable areas).

It should be noted that the provincial Riparian Area Regulations do not apply to the study area, based on the park land use. The federal Fisheries Act applies, making it imperative to ensure that the proposed upgrades to the park, especially those located in riparian areas, do not negatively impact upon fish or fish habitat. Further details regarding regulatory requirements and mitigation are discussed in Section 5.

5.0 MANAGEMENT OF POTENTIAL IMPACTS

5.1 Proposed New Trail Construction and Trail Upgrades

The proposed new trails indicated on Figure 3 would consist of a clean "cart path" gravel surface approximately 1.5 m wide. Very minimal (if any) excavations would be required, as the gravel would be placed directly over the ground surface. Clearance of shrub vegetation would be necessary along the trail corridors. Trail upgrades (placement of pea gravel) would be completed on the main, high use trails.

Potential impacts to ecological attributes and focal species habitat are very low, based on the minimal footprint of the proposed trail development. The seasonal access to the river for dogs would not lead to the removal of functioning riparian vegetation, as the trail footprint would access the river at an existing cleared area (old road access). The gravel bar in the river at the access point is dry during the summer, but is inundated with water during high flow events in the autumn and winter months. No direct negative impacts to fish or fish habitat are expected as a result of the proposed trail upgrades or new trail developments.

Indirect impacts that may occur are associated with disturbance to fish and wildlife from dogs and people in newly accessible areas. There is the potential for disturbance to spawning salmon during the autumn months as a result of dogs accessing the river. It should be noted that the same potential impact exists under the current regime, as dogs and people have direct access to the river from the trail on the eastern side. Upgrading the trail system and providing a new dog access point introduces the potential for education about sensitive life stages of

fish (e.g. spawning) and the negative effects of disturbance during these critical periods.

5.1.1 Regulatory Requirements

As the upgrades are occurring in a Regional District park, the provincial Riparian Area Regulations (RAR) will not be triggered by any work within the Riparian Assessment Area (a 30 m zone adjacent to both sides of a stream). The on-line Fisheries and Oceans (DFO) project notification and review process, however, will be applicable. In this case, a Project Review and Application Form (PRAF) would need to be completed and submitted. The PRAF would include a summary of the proposed work, the type of habitat affected and mitigation measures. Based on the minimal footprint of the work and low potential for negative impacts to fish or fish habitat, a Notification, as opposed to a full project review, would be completed. The DFO would need at least 10 days notice prior to the initiation of any works within 30 m of a stream.

The provincial Wildlife Act (Section 34C) affords protection to nesting birds, and it is illegal to possess, take, injure, molest or destroy the nest of a bird when the nest is occupied by a bird or its eggs. In addition to Section 34C of the provincial Wildlife Act, migratory birds are also afforded protection under the federal Migratory Birds Convention Act (Section 6). It is illegal to destroy or take a nest, egg or nest shelter of a migratory bird. Migratory birds covered under the Migratory Bird Convention Act include a number of species that are likely to breed in terrestrial habitats within the general vicinity of the assessment area, including hummingbirds, warblers and flycatchers.

The vast majority of bird species that may breed in the study area will complete their breeding cycle between April 1st and July 31st. The assessment area will be used by both migratory and non-migratory birds. To avoid the destruction of active nests, we recommend that activities that lead to the loss of potential nest sites (e.g. clearing shrub vegetation to construct the trails) be suspended between April 1st and July 31st. If activities cannot be suspended during this period in potential nesting habitat, specific areas can be checked for nest sites prior to disturbance to prevent impacts to breeding birds.

5.1.2 Deleterious Substances

5.1.2.1 Control of Hydrocarbons

Machinery used to construct the trails would likely consist of a mini excavator and/or mechanized wheelbarrow to transport and spread the gravel surface. Chainsaws may also be required to clear some of the larger diameter shrub vegetation. Use of machinery introduces the potential for the introduction of deleterious substances (e.g. petroleum products) into the natural environment.

Machinery must be in good working order, clean (power washed) and free of leaks, excessive oil and grease. For work within 30 m of any watercourse, all hydraulic machinery must operate using environmentally-sensitive hydraulic fluids that are readily or inherently biodegradable. As it is not possible to control the dispersal of chain oil from a running chainsaw, biodegradable chain oil must also be used. Refueling of all machinery must occur at least 30 m from the edge of any watercourse.

Each piece of machinery working on site must contain a small, storable emergency spill containment kit with at least a 30 litre sorbent capacity. In addition, a "first response spill kit", with a sorbent capacity of at least 80 litres (approximately half the size of a garbage can) must be located at the work site. Work crews must make themselves familiar with the contents of the spill kits and must know how to deploy the contents to effectively control spills.

Even if a spill of biodegradable fluid occurs, it is important to respond with a spill kit, as the oil will persist in the environment until it breaks down naturally. The advantage with using biodegradable oil is that no toxic residue remains.

The smaller (30 litre sorbent capacity) spill kits must contain the following:

20 absorbent pads (for oil, gas and diesel);

2 x 3"x 4' absorbent socks;

2 disposal bags; and

1 pair of Nitrile gloves.

The "first response" spill kits (80 litre sorbent capacity) must contain the following:

30 absorbent pads (for oil, gas and diesel);

15 universal absorbent pads;

2 x 18" x 18" oil absorbent pillows;

3 x 3" x 4' absorbent socks (for oil, gas and diesel);

6 disposal bags;

2 pairs of Nitrile gloves;

1 spill instruction sheet; and

1 laminated list of contents.

5.1.2.2 Erosion and Sediment Control (ESC)

The most appropriate method to control sediment is to manage potential sediment sources. If potential erosion sources are managed properly, sediment cannot be mobilized. Generally, the impact of rain drops upon an exposed (*i.e.*, un-vegetated) surface provides sufficient energy to detach soil particles (depending upon particle size), which then become entrained in surface flowing water. Best Management Practices (BMP) that are focused on protecting recently exposed soils are extremely useful, therefore, as erosion is curtailed.

It should be noted that BMPs such as sediment fencing must not be relied upon as the only ESC measure. As discussed, if erosion is controlled at the source, there should be no need for a sediment fence. Sediment fencing can be an effective tool in ESC, but should be viewed as a secondary control measure, with erosion control being the primary focus.

The potential for the creation of sediment during the trail construction process is very low, based on the lack of excavations required. The use of machinery, however (e.g. tracked machines), may lead to the exposure of bare soils. Appropriate timing of the work (e.g. late summer, after the end of the breeding bird season) will help ensure that sediment does not become transported.

As a BMP, any exposed surfaces must be covered with suitable organic mulch (e.g. straw). Hay must not be used as mulch, as it often contains seeds of undesirable plant species. As areas are exposed, straw must be applied (where applicable) by hand. It is worth noting that in order to obtain adequate coverage to avoid erosion, 1 straw bale will effectively cover approximately 20 – 25 m^2. Straw should be placed evenly at a thickness of 2.5 cm – 5.0 cm, and should cover between 80% and 90% of the surface.

5.1.3 Management of Vegetation

5.1.3.1 Minimizing Impacts to Native Vegetation

New trail footprints must be "field fit" to avoid the requirement to remove any trees. The width of the trails must also be kept to the absolute minimum. The shrub vegetation in the area of the dog beach access trail is dense in places, requiring the clearance of vegetation for the trail corridor. The river access trail will not involve the removal of vegetation in the immediate riparian zone, or disturbance to the river bank, as it will make use of a natural clearing associated with an old road access.

The potential phase 2 extension of the dog trail, involving the completion of a loop back up to the parking area, would be situated in a clearing consisting of dense reed canary grass. In this area, no shrub vegetation clearance would be required. The connection of the phase 2 trail loop to the parking area would require the clearance of shrub vegetation (and potentially construction of stairs) along the steep forested slope below the parking area.

To avoid the potential for impacts to adjacent tree roots during trail construction (e.g. through compaction or direct damage from tracked machinery), rubber-tracked machinery must be used. Care must also be taken to avoid direct damage to tree limbs or stems (especially during the construction of the extended trail through the mature riparian forest comprising Polygon 1). The potential for impacts would be limited by the fact that lightweight machinery would be used (e.g. mini excavator).

The gravel surfacing proposal would prevent impacts to tree roots associated with trampling (e.g. root exposure) once the trails are complete. On existing trails, the planned surfacing upgrades will help prevent damage to tree roots, which is currently occurring as a result of foot traffic. Exposed roots, worn down from the action of trampling, were noted along the trail on the eastern side of the river. The addition of a gravel surface will cover these roots, and provide a protective barrier from foot traffic.

Consideration may be needed for appropriate vegetation management techniques if the proposed loop extension is added to the existing trail along the eastern side of the river. As per Figure 3, the trail would cross a very moist seepage area and small stream, if constructed in the proposed location. If an alternate route cannot be identified, a raised boardwalk is recommended to avoid any potential impacts

to the hydrophytic vegetation assemblage in this area. A small footbridge would also be required over the stream. Prior to finalizing the precise location of any trail, site specific impact assessments should be carried out to determine the most appropriate positioning to avoid potential impacts to ecological attributes.

5.1.3.2 Invasive Species Management

5.1.3.2.1.1 Species Occurrence

The proposed trail work introduces the potential opportunity to manage invasive plant species. Several introduced/invasive species were noted (especially in open areas in Polygon 2) during the assessment (e.g. Canada thistle, Japanese knotweed, common burdock, perennial pea vine, Himalayan balsam and Himalayan/European blackberry). Of these species, the Japanese knotweed and Canada thistle are considered noxious weeds under Schedule A of the provincial Weed Control Regulation: (http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_66_85#ScheduleA).

Reed canary grass was also noted, although there are differing opinions as to whether this species is considered as an introduced species, or whether it is indigenous to some coastal areas and has extended its range as a result of human influences, such as agriculture (Pojar and MacKinnon 1994). Under Section 2 of the provincial Weed Control Act: (http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96487_01), a land owner is required to control noxious weeds.

5.1.3.2.1.2 Removal Methodology

Japanese knotweed represents the most important species to control, based on the ability of this species to spread, and the proximity of a natural dispersal vector (the Koksilah River). In addition, the infestation of this species at Bright Angel Park is currently limited to a few occurrences. Based on the current spatial distribution of Japanese knotweed (mainly limited to isolated occurrences in Polygon 2), repeated cutting may be the best option. Digging out the plant is not recommended, as this would lead to significant disturbance. Cutting the plants diligently every 2 – 3 weeks during the main growing season for at least 3 years may exhaust the energy reserves in the underground rhizome. Care must be taken to remove all cut stem material and dispose of it properly, as Japanese knotweed can propagate from an extremely small portion of residual plant. Any new infestations that are encountered must be addressed quickly.

While not the preferred choice for the control of Japanese knotweed (especially in riparian areas), herbicide use may also be an option. As per recommendations made in the B.C. Ministry of Agriculture riparian factsheet for management of weeds in riparian areas (2012), herbicide use in riparian areas should be short term only to eliminate specific species, should be spot-treatment only (avoiding potential impacts to established native vegetation), and must be carried out under appropriate authorization/permitting via the DFO.

Himalayan blackberry and European blackberry are limited in extent to small thickets in open areas of Polygon 2. Removal of these species may be successful if properly managed, based on the current limited extent. Blackberry can be cut with a bladed brush cutter, which helps to remove the above-ground portion of the plant. Removal of blackberry canes by cutting alone, however, is insufficient, as the plant will continue to resprout from the subsurface root network.

Repeated cutting over multiple years is required in order to deplete the energy reserves in the root network. Cutting efforts are most effective when the plant begins to flower, as the energy reserves in the roots are depleted. Following the initial cut of the above-ground blackberry canes, follow-up treatment such as hand digging is beneficial. Tools such as claw mattocks and pulaskis are useful implements for digging out root crowns. Digging would need to be thorough, as root fragments left in the ground have the potential of producing new plants.

Himalayan balsam occurs throughout Polygon 2, especially in the more open areas. This plant is not associated with the deep, spreading rhizomes typical of Japanese knotweed and can, therefore, be pulled easily from the ground. Based on the dispersal mechanism of this plant, in which the seed pods split and eject the seeds, this plant must not be removed once it has gone to seed, to avoid inadvertent dispersal.

5.1.3.2.1.3 Follow-up Treatment

It is important that where invasive species have been removed, these open areas are treated appropriately to prevent the re-establishment of unwanted species. Prompt establishment of native species can help out-compete invasive plants. The use of live staking should be considered as an option, which involves the use of pioneer woody species that are planted at a relatively high density to create a fast-growing cover of native plants.

Live staking uses species such as willow, black cottonwood and red-osier dogwood. When planting cuttings (live stakes), the planting density should be relatively high, with less than 50 cm between each cutting. Live stakes should be at least 2 m long with a diameter of at least 2.5 cm, and all sucker growth must be removed at time of harvest (Figure 4). Areas treated for invasive species removal in Polygon 2 will likely be well suited to the growth of species such as willow and cottonwood, based on the relatively high moisture content of the soil. Red osier dogwood may not be as well suited to this area, as only isolated occurrences were noted in moister depressions.

Stakes should be bundled and soaked in running (oxygenated) water for at least 24 hours prior to being planted. Stakes must be inserted into the ground to a depth of at least 1 m. To help achieve this depth requirement, a hole must first be prepared using a heavy metal bar, into which the stake is inserted. It is of paramount importance that adequate planting depths are achieved, to ensure that the plants become established.

To achieve successful growth, the stakes should ideally be harvested prior to the donor plant breaking dormancy in the spring. Stakes can also be harvested in the fall, after the majority of the leaves have dropped.

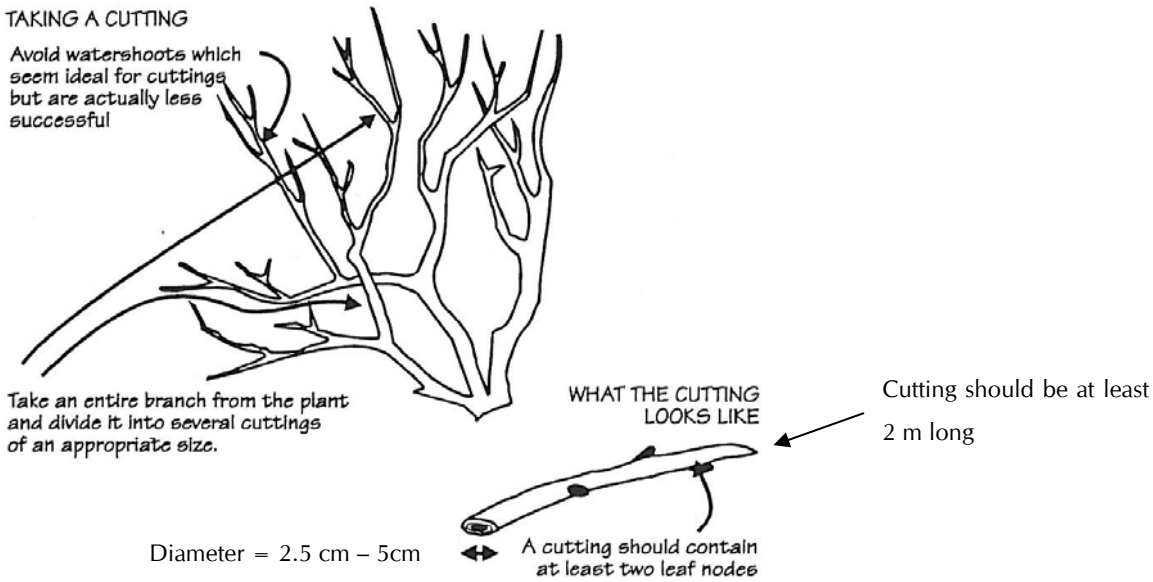


Figure 4. Procedure for taking live stake cuttings from donor plant. (Figure modified from Streamkeepers Handbook, 1995[1]).

[1] Available at: http://www.pskf.ca/publications/Handbook.pdf

5.1.4 Long Term Considerations

The proposed trail upgrades will allow for the existing trail network to be defined, which will help reduce the impact of foot traffic in sensitive areas (e.g. along the eastern side of the Koksilah River). At present, there is no real defined "trail" along the eastern side of the river, and a broad area of disturbance has resulted. For example, trampling has worn down the substrate and exposed tree roots, which are now subject to degradation. Placing a gravel surface in this area will help define the trail, while also helping to cover and protect tree roots that are currently exposed.

There are no defined river access points along the trail on the eastern side of the river, which has allowed people to create multiple "informal" access routes through the riparian area. In order to protect the riparian zone, a potential management option could be to fence the edges of the upgraded trail where it runs parallel to the river's edge, and create one defined access point to the river. The fence would need to be an aesthetically-pleasing design, such as a low cedar rail structure, and must allow for unimpeded movement of wildlife.

Creating a seasonal access trail to the river for dogs in the area shown on Figure 3 introduces the possibility for increased interaction between wildlife and dogs in an area that is currently inaccessible. It also introduces the potential for disturbance to fish during sensitive life stages (e.g. spawning). These potential interactions also exist with the current regime. It should be noted that the majority of trail use will be focused in the summer months, during a time when the potential risk associated with negative impacts to sensitive fish life stages from disturbance agents (e.g. dogs) is minimal.

In order to reduce the potential for negative impacts, access to the river via the proposed new dog trail could be limited to the summer months only, with access to the river for all users provided via the existing trail on the eastern side during the autumn and winter months. This would fit with the management objective to segregate dogs and people during the summer months only. Interpretive signs could also be erected educating public about the importance of preventing their dogs from entering the river during critical times (e.g. salmon spawning season).

The dense shrub vegetation throughout the area where the proposed new trail will lead to the river will discourage people from wandering off the trail. It is likely, however, that dogs will be able to access areas beyond the confines of the trail, unless they are properly controlled. The potential exists for dogs to chase

and harass wildlife (e.g. Columbian Black-tailed Deer, Roosevelt Elk and Black Bears). It should be noted that this potential impact currently exists at the park, although creating a new trail will extend the area where interactions could occur.

To help prevent negative impacts to wildlife, the proposed new dog trail could be fenced with a low cedar rail structure adequate to discourage dogs from leaving the confines of the trail. As an added measure, interpretive signs could be set up informing dog owners of the importance of keeping their dogs under control. These signs should be used as a management tool on existing trails also.

It is very unlikely that providing access to the river for dogs in the area shown on Figure 3 will lead to degradation of the riparian zone. The trail will connect with a natural clearing adjacent to the river, which appears to represent an old road access point. The tree and shrub vegetation on each side of the clearing is very dense, with steep banks leading to the river, which naturally limits the potential for people to create their own access points.

5.2 Construction of New Change Room Building and Upgrades to Recreation Amenities

The suggested location options for construction of a new building with change room and toilet facilities will occur over an existing footprint. Replacement of the playground and fitness circuit stations in the location options suggested will also be occurring on existing disturbance footprints. The upgrading of the open field to provide a level playing field for sports activities (e.g. volleyball) will not result in any negative changes from an ecological perspective, as the playing field will be in an area that already consists of an open field.

All upgrades to park amenities will be occurring at least 50 m from the Koksilah River, and no negative impacts are expected to the river or surrounding forested ecosystems as a result of the upgrades. In addition, no vegetation will be removed as a result of the proposed construction or recreation amenity upgrades, as the activities will be occurring on existing cleared footprints.

Upgrading the toilet facilities will allow the existing pit toilets that are interspersed throughout the park to be removed. Waste will be managed more appropriately through the installation of a septic system, built as part of the change room/toilet facility. Prior to the removal of the pit toilets, the specific protocol involved with emptying or capping the underground receptacles will

need to be checked. It is important that the toilets are decommissioned appropriately and that there is no potential for the migration of human waste from the pit toilets to the river via groundwater. It should be noted that removing the pit toilets and installing a septic system will improve upon the existing regime of waste management.

To ensure that the park upgrade work is completed in an ecologically sound manner, appropriate techniques must be employed to manage stormwater (regarding both quality and quantity) associated with the new building. Impermeable surfaces, such as concrete, asphalt roads and rooftops generally increase the amount of stormwater leaving a site in comparison to pre-development conditions. Infiltration capacity is reduced, and short-term surface run-off associated with rain events increases. Elevated stormwater run-off can have negative impacts on connected watercourses, including a potential increase in short-lived peak flow events and a decrease in the long-term supply of water to a system, which can result in lower flows in the summer months.

Increased peak flows can potentially impact fluvial environments by flushing alluvial material from the system (e.g. increased scour), which can have repercussions on the availability of spawning habitat. Stream banks can also become more unstable, which can lead to an increased potential for fine sediment transportation. An increase in the frequency of summer low flow events can lead to a decrease in available wetted habitat for fish.

It should be noted that any increases in stormwater as a result of the proposed upgrades would be negligible, based on the scope of the project and minimal footprint. But, it is usually the combination of multiple "insignificant" factors that lead to negative impacts, based on cumulative effect, necessitating the proper management of stormwater in this case.

The goal of stormwater management is to capture storm flow and return it to natural hydrological pathways. Ideally, stormwater management initiatives associated with the project should aim towards a "no net gain", or improvement, in stormwater compared to existing conditions. Potential solutions to stormwater management, which will require additional design beyond the scope of this assessment include: construction of a rain garden; installation of a "green roof"; construction of rock-lined infiltration chambers; or development of bio-swales.

Despite the fact that construction activities will be occurring well beyond the riparian influence of the Koksilah River, it is important to ensure that deleterious substances, such as petroleum products from machinery and sediment generation from exposed surfaces, are properly managed. All machinery must be equipped with 30 litre sorbent capacity spill kits, and a "first response" spill kit must also be present on site, as detailed in Section 5.1.2.1.

Any potential for erosion from exposed surfaces must also be managed appropriately during the construction phase of the new building. No detailed prescriptions have been formulated at present for erosion and sediment control, but the appropriate use of organic mulches is recommended to protect exposed areas and prevent the potential for erosion. Based on the location options under consideration and the construction activities associated with the new building, the potential risks involved with sediment mobilization from the site to sensitive areas (e.g. the Koksilah River) are very low.

Throughout all development activities, independent monitoring will help ensure that ecological values are maintained and mitigation measures are implemented properly. Monitoring would be most important in new development footprint areas, such as the proposed dog trail accessing the river, or constructing the trail extension through the mature riparian forest on the eastern side of the Koksilah River.

If you have any questions or concerns, please do not hesitate in contacting the undersigned.

Prepared by:

Trystan Willmott, B.Sc., A.Sc.T.

Reviewed by:

Jackie Churchill, M.Sc., R.P.Bio., A.Sc.T.

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APPENDIX I – SITE PHOTOS

Looking north over the lower parking area at the potential location for the new wash room building.

Looking south over the lower parking area at the potential location of the new wash room building.

Existing children's playground. Options include placement of a new playground in this area and/or outdoor fitness circuit equipment.

Example of part of the main circular trail to the north west of the lower parking area. The surfaces of these main trials would be upgraded with pea gravel as part of the proposal.

Existing surface of the trail running along the eastern side of the Koksilah River. Note broad area of disturbance from foot traffic and resulting exposed tree roots. The trail should be better defined and re-surfaced, to protect the exposed roots and prevent further degradation.

Looking south-east over the open field and the caretaker's residence. Part of the proposed upgrades would involve improving the surface of the field (e.g. leveling).

Looking north west over the open field.

Example of a pit toilet in the park. Part of the planned upgrades would involve the removal of these structures, with replacement facilities provided as part of the new wash room building (including installation of a new septic system).

Looking west from the gravel substrate of the Koksilah River towards the opening through the riparian area where the proposed new dog trail would access the river.

Looking east along the old access road towards the opening in the riparian area where the proposed new dog trail would access the river.

Typical dense shrub vegetation located throughout the southern portion of Polygon 2, where the proposed new dog trail would be constructed.

Reed canary grass in open areas throughout the central and northern portions of Polygon 2. The potential phase 2 extension of the dog access trail would be constructed through this area, allowing an alternate route back to the parking area.

Policeman's helmet (Himalayan balsam) occurred frequently through Polygon 2, especially in the more open areas.

Perennial pea vine found throughout open areas in Polygon 2.

Canada thistle found throughout open areas of Polygon 2.

Example of Himalayan blackberry thicket found in Polygon 2.

Veteran Douglas-fir in the immediate riparian area of the Koksilah River – Polygon 1 (mature riparian forest).

Veteran western redcedar in the immediate riparian area of the Koksilah River – Polygon 1. Note occurrence of natural cavities in the tree, providing nesting opportunities for bird and roosting habitat for bats.

Broken top of small conifer resting on the top of a Pacific yew – immediate riparian area of the Koksilah River (Polygon 1). Removing this top from the yew tree may increase the health and survival chances of the yew.

Typical composition of the western redcedar-bigleaf maple forest found throughout the majority of Bright Angel Park (Polygon 3).

Example of flood rafted debris and seasonally inundated channels throughout the active floodplain found in Polygon 4.

Moist seepage area flowing along the base of the slope in the northern portion of Polygon 1. Note considerable use of this area by ungulates (deer and elk).

Seasonally-inundated depression located along the seepage area pictured above. Depression such as this will provide potential breeding opportunities for amphibians which are able to complete the metamorphosis from tadpole to adult relatively quickly (e.g. Pacific chorus frogs)

Example of seasonally-inundated depression located in the southern portion of Polygon 3.

Dense slough sedge growth in the wetland located close to assessment plot 5.

Looking east (upstream) along the seasonally flowing stream connecting with the seepage area located in the northern portion of Polygon 1.

Wildlife tree located in Polygon 2. Note abundance of cavities available for cavity-nesting birds.

Wildlife tree with evidence of woodpecker feeding activity found near assessment plot 5.

Elk print found close to the moist seepage area in the northern portion of Polygon 1.

Black Bear scat containing apple remains found on the railway tracks adjacent to the eastern boundary of the park.

Old beaver tooth marks on a bigleaf maple stump located close to the Koksilah River in Polygon 1.

APPENDIX II – STRUCTURAL STAGES AND CODES

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Structural Stages and Codes

(As per *Land Management Handbook 25: Field Manual for Describing Terrestrial Ecosystems*, 2010)

Structural Stage	Description
Post-disturbance stages or environmentally induced structural development	
1 Sparse/cryptogam	Initial stages of primary and secondary succession; bryophytes and lichens often dominant, can be up to 100%; time since disturbance less than 20 years for normal forest succession, may be prolonged (50–100+ years) where there is little or no soil development (bedrock, boulder fields); total shrub and herb cover less than 20%; total tree layer cover less than 10%.
Substages	
1a Sparse	Less than 10% vegetation cover;
1b Bryoid	Bryophyte-dominated communities (greater than ½ of total vegetation cover).
1c Lichen	Lichen-dominated communities (greater than ½ of total vegetation cover).
Stand initiation stages or environmentally induced structural development	
2 Herb	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g. snow fields, avalanche tracks, wetlands, grasslands, **flooding**, intensive grazing, intense fire damage); dominated by herbs (forbs, graminoids, ferns); some invading or residual shrubs and trees may be present; tree layer cover less than 10%, shrubby layer cover less than or equal to 20% or less than 1/3 of total cover; time since disturbance less than 20 years for normal forest succession; may herbaceous communities are perpetually maintained in this stage.
Substages	
2a Forb-dominanted	Herbaceous communities dominated (greater than ½ o the total herb cover) by non-graminoid herbs, including ferns.
2b Graminoid-dominated	Herbaceous communities dominated (greater than ½ of the total herb cover) by grasses, sedges, reeds, and rushes.
2c Aquatic	Herbaceous communities dominated (greater than ½ of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b).
2d Dwarf shrub	Communities dominated (greater than ½ of the total herb cover) by dwarf woody species such as *Phyllodoce empetriformis, Cassiope mertensiana, Cassiope tetragona, Arctostaphylos arctica, Salix reticulata*, and *Rhododendron lapponicum*. (See list of dwarf shrubs assigned to the herb layer in the *Field Manual for Describing Terrestrial Ecosystems*).
3 Shrub/Herb	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g. snow fields, avalanche tracks, wetlands, grasslands, **flooding**, intensive grazing, intense fir damage); dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree layer cover less than 10%; shrub layer cover greater than 20% or greater than or equal to 1/3 of total cover.
Substages	
3a Low shrub	Communities dominated by shrub layer vegetation less than 2 m tall; may be perpetuated indefinitely to environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 20 years for normal forest succession.

Structural Stage	Description
3b Tall shrub	Communities dominated by shrub layer vegetation that are 2–10 m tall; may be perpetuated indefinitely by environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 40 years for normal forest succession.
Stem exclusion stages	
4 Pole/Sapling	Trees greater than 10m tall, typically dense stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually greater than 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy – this often occurs by age 30 in vigorous broadleaf stands, which are generally younger than coniferous stand at the same structural stage; time since disturbance ins usually less than 40 years for normal forest succession; u to 100+ years for dense (5,000 - 15,000+ stems per hectare) stagnant stands.
5 Young Forest	Self-thinning has become evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped); vigorous growth and a more open stand than in the pole/sapling stage; time since disturbance is generally 40–80 years but may begin as early as age 30, depending on tree species and ecological conditions.
Understorey reinitiation stage	
6 Mature Forest	Trees established after the last disturbance have matured; a second cycle of shade tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance is generally 80–250 years for stands within the CWH.
Old-growth stage	
7 Old Forest	Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstoery; long-lived seral species may be present in some ecosystem types or edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems.
Substages	
7a Old Forest	Stands with moderately to well developed structural complexity; stands composed mainly of shade-tolerant and regenerating tree species, although older seral and long-lived trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand replacing disturbance generally greater than 250 years for stands within the CWH.
7b Very Old Forest	Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris; snags and coarse woody debris in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand replacing disturbance generally greater than 400 years for stands within the CWH.

Stand Composition	Description
A description of the leaf-types of trees in a stand (only for structural stages 3-7)	
C	Coniferous (>75% of total tree cover is coniferous)
B	Broadleaf (>75% of the total tree cover is broadleaf)
M	Mixed (neither coniferous or broadleaf account for >75% of the total tree cover)

APPENDIX III – FOCAL SPECIES ACCOUNT SUMMARIES

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Northern Goshawk (Red-listed)

Benchmark habitat for the Northern Goshawk consists of an open understory, relatively high canopy cover, moderate slope, and abundant coarse woody debris (CWD) (McClaren, 2004 and Proulx *et al.,* 2003). CWD is an important habitat feature of this species because it creates suitable habitat for prey items, such as small mammals and birds.

Keen's Long-Eared Myotis (Red-listed)

Davis *et al*., (2000, as cited in Chatwin, 2004) indicated that caves >100 m in length and above 500 m elevation are known to be important winter hibernation sites for myotis bats. Rock faces and knolls with crevices that are solar or geothermally heated are important maternity roosts while tree cavities in wildlife trees and loose bark are important natural roost sites and may be limiting in some parts of their range. Insect-rich low elevation coastal forest and riparian areas are important foraging areas.

Common Water Shrew (Red-listed)

The Common Water Shrew depends upon structurally diverse riparian areas adjacent to streams and lakes for all stages of its life cycle (Proulx *et al.,* 2003). Water shrews prefer swift flowing, high elevation, streams with rocks and boulders present. Leaf litter, CWD, hollow logs, exposed tree roots; undercut stream banks and overhanging riparian vegetation are key habitat features for this species.

Western Painted Turtle – Pacific Coast Population (Red Listed)

This species uses shallow ponds, lakes, marshes and slow-moving streams. Wetlands with muddy substrates are suitable, but emergent vegetation and basking sites (e.g. CWD) are an important habitat attribute (Species at Risk Public Registry, 2012). Riparian habitat is also important, as females will lay their eggs up to 150 m from the water's edge (Species at Risk Public Registry, 2012). Due to continued habitat loss and human-related development pressures, the number of western painted turtles is declining, with an estimated population of only 250 adults occurring in B.C. (Species at Risk Public Registry, 2012).

Olive-sided Flycatcher (Blue-listed)

This species will breed in a variety of forest types, including along the edges of lakes, ponds and streams. Dead standing trees are an important habitat feature, as they serve as singing and feeding perches (BC CDC, 2012). Nesting usually

occurs in the limbs of coniferous trees 2 m – 15 m from the ground (BC CDC, 2012).

Marbled Murrelet (Blue-Listed)

This species typically nests in trees in coastal old-growth forests or mature forests with old growth characteristics (Burger 2004). For nesting, murrelets require mossy, epiphytic growths on the horizontal limbs or similar platform-like structures in trees that generally are older than 140 years (Nelson, 1997).

Green Heron (Blue-listed)

The Green Heron makes use of various habitats, including rivers, lakes, ponds, reservoirs, estuaries, beaches and sloughs (Fraser and Ramsey, 1996). With respect to nesting, two main habitat types are important for Green Herons. Shallow and/or slow-moving water represents important forage habitat while dense trees and tall shrubs close to a water body are important nesting habitat. The majority of Green Heron observations (29%) that have been associated with habitat have been in sloughs, marshes and swamps (Fraser and Ramsey, 1996). Fraser and Ramsey (1996) also noted that during the breeding season, sloughs, lakes and marshes are the most important habitats.

Band-tailed Pigeon (Blue-listed)

In the US Pacific Northwest, this species is found primarily below 1000 m in fir-hemlock-redcedar-spruce stands (Braun, 1994). Nesting occurs in virtually all habitat types and areas which are rich in berry-producing shrubs and bud-producing deciduous trees.

Northern Pygmy Owl (Blue-Listed)

The Northern Pygmy Owl has been reported to breed in mature and second-growth coniferous forests, mixed riparian forest, and pure deciduous stands, preferring habitat near the edge of forest openings, rather than in interior forest (Johnsgard, 1988). Small owls, in general, are largely dependent on woodpecker cavities for nesting and roosting habitat. In British Columbia, the Northern Pygmy Owl prefers edges of open coniferous forests or mixed woodlands during the breeding season (Campbell *et al.,* 1990).

Western Screech Owl (Blue-Listed)

In the northern portion of its range, the Western Screech Owl is generally found in lower elevation forested habitat, especially in mixed (coniferous and deciduous) riparian forests (Johnsgard, 1988). This species will roost in tree cavities, on branches, and in nest boxes (Johnsgard, 1988). Like the Northern Pygmy Owl, this species is a secondary cavity nester and is largely dependent on the excavations made by large woodpecker species such as Northern Flickers (*Colaptes auratus*) and Pileated Woodpeckers (*Dryocopus pileatus*).

Great Blue Heron (Blue-Listed)

This species is adaptable to a variety of habitats. Great Blue Herons nest in trees, bushes, on the ground and in artificial structures (Butler, 1992). Nest selection is predator-driven, and nests can be found high in trees as well as on islands in the middle of lakes, ponds and swamps (Butler, 1992).

Townsend's Big-Eared Bat (Blue-listed)

The habitat requirements of Townsend's Big-Eared Bat mirror those of Keen's Long-eared Myotis.

Roosevelt Elk (Blue-Listed)

Coastal Roosevelt Elk are often found in low elevation early seral forests or meadow habitats, which provide winter-spring forage in the form of sedges, grasses, ferns, willows and berry producing shrubs. In the summer months, most elk migrate to higher elevation subalpine meadows or avalanche tracks (BC MELP, 2000). In the study area, the local elk herd has adapted to foraging in agricultural areas. The elk also make use of rural residential habitat, feeding on high value forage such as fruit trees.

Northern Red-legged Frog (Blue-Listed)

The life history of this species requires heavily vegetated aquatic areas in which to breed, and a terrestrial habitat component dominated by tall shrubs, coarse woody debris, and a relatively flat substrate (Maxcy, 2004).

Western Toad (Blue-Listed)

Habitat requirements of the Western Toad are very similar to that of the Red-legged Frog.

Dun Skipper (Blue-Listed)

Little is known about the habitat preferences of this butterfly. This species is thought to depend on moist, open areas containing sedges, which the larval stage feeds on (Pearson and Healey 2012). Limited data exists regarding population size, but it is thought to be in decline, based on a decrease in sightings (Pearson and Healey, 2012). The main threats to this butterfly are associated with habitat loss, degradation and fragmentation (Pearson and Healey, 2012).

Moss's Elfin (Blue-Listed)

This species is associated with Garry oak (*Quercus garryana*) ecosystems (BC CDC, 2012). This ecosystem assemblage has become fragmented due to human encroachment and associated pressures (e.g. invasive species infestations), which has led to a decline in the population of this species (BC CDC, 2012). Stonecrop (*Sedum* sp.) is known to be an important food plant for this butterfly (BC CDC, 2012).

Bald Eagle (Yellow-listed)

Bald Eagles are a significant and conspicuous component of the BC avifauna, especially on the coast. Bald Eagles are generally considered ecologically significant, as they are keystone predators, helping to regulate other bird populations (Environment Canada, 2004). They also have a very high public profile, and are significant in the BC ecotourism industry.

Bald Eagles are large birds with some specific and exacting perching and nesting habitat requirements. Throughout the coastal forests, Bald Eagles nest typically in large, old trees that have developed sufficiently stout limbs to support their often huge nests. They exhibit a strong preference for large, dominant or co-dominant trees in a heterogeneous stand of mature or old-growth coniferous timber (Stalmaster *et al.*, 1984). The preferred trees also need to be in a strategic location, with a good viewscape of the surroundings and, importantly, a good line of sight to a nearby productive feeding area.

The best territories are thus likely to include:

- Highly productive feeding area(s) (*i.e.*, shoreline, salmon river and/or well stocked lake);
- A number of actual and potential nest trees present; and

- A good selection of ideal perching and roosting trees, well distributed in strategic sites throughout the territory.

Black Bear (Yellow Listed)

In spring, skunk cabbage in wetter areas provides an important foraging opportunity for bears. In summer and fall, bears often occupy open sites (e.g. clearcuts and roadsides) with abundant berries. Annual salmon runs also provide a very important food source for this species. Hibernation sites are frequently found in large hollow trees, under fallen trees, and any other hollow cavity on drier, well drained south and southeast facing slopes.

Columbian Black-tailed Deer (Yellow Listed)

Deer often occupy warmer aspect slopes with thermal/security cover from a closed forest canopy, and frequent dense low-lying shrub areas to feed. In summer, this species occupies areas rich in berry-producing shrubs and fresh herbaceous plants (e.g. burned areas, roadsides and clearcuts). As with the local elk herd, deer have become adapted to foraging in rural residential areas and in agricultural fields in proximity to the study area.