Nymph Falls Nature Park Bio-Inventory – July, 2018

For the Comox Valley Regional District

By Kayt Chambers, R.P. Bio., Baynes Sound Environmental
and Wendy Kotilla, R.N.S. Dip., Youth and Ecological Restoration

TABLE OF CONTENTS:

ACKNOWLEDGEMENTS

The Youth and Ecological Restoration Program (YER) is funded by the BC Ministry of Children and Family Development (MCFD) to provide vulnerable youth with work experience, ecotherapy and support. Comox Valley Regional District (CVRD) partnered with YER to provide funds for a professional biologist to work with two youth in Nymph Falls Nature Park. Thanks to CVRD, Doug DeMarzo and Brian Allaert, and MCFD, Curtis Cameron for continuing to support youth learning about and working with the natural landscapes of the Comox Valley.

1.0 INTRODUCTION

1.1 Background:

YER (www.youthecology.ca) was created by Wendy Kotilla in 2004. For over 14 years YER has helped 331 vulnerable youth in the Comox Valley. YER provides youth aged 12 to 18 with one-on-one work experience through ecological restoration methods, ecotherapy practices and mentoring support. YER, Phase I has youth working with several local environmental groups and giving an oral presentation; YER, Phase II is a specific project working with two youth and an environmental professional. YERII focus is for youth to conduct scientific research techniques, and instill teamwork and communication skills.

Since 2012 YER has partnered with CVRD to conduct ecological inventories in regional parks which has included: Seal Bay Nature Park, Wildwood Interpretive Forest, Bear Creek Nature Park, Headquarters Townsite Park, Driftwood Marine Park and Trent River Park. These partnerships have benefited CVRD and YER, and are intended to involve youth with meaningful environmental work while providing CVRD with ecological information about local parks. YERII is a 5 day format; 3 days of field work and 2 days of preparation for and delivery of a public tour.

Kayt Chambers is a professional biologist with over two decades of field biology experience. She has worked in the field in marine, freshwater, and terrestrial

environments in a range of habitats within the CVRD. Kayt has conducted several bio-inventories such as this to account for the ecological condition of an area as part of a wider Environmental Impact Assessment (EIA) that typically encompasses social, economic, heritage and health values as well.

This CVRD and YER partnership in Nymph Falls Nature Park is part of a larger CVRD project that proposes the development of a narrow service road through Nymph Falls Nature Park to allow maintenance of a public outhouse facility near Nymph Falls – a feature that attracts a growing number of people each year. Additionally, the CVRD has proposed the construction of a viewing platform at the edge of Nymph Falls to increase accessibility and enjoyment of users in the park.

As part of the regulatory requirements under the federal *Species-at-Risk Act* and the provincial *Wildlife Act*, three species with SAR status in this region require field assessment in the Nymph Falls Nature Park area prior to the proposed development to allow effective construction design and adequate mitigation planning. This report is a summary of the bio-inventory completed of habitats for these species by Kayt Chambers, R.P.Bio.; YER Coordinator, Wendy Kotilla; and YER youth participants Jade Antoine and Ethan Ashurst.

1.2 Study Location:

Nymph Falls Nature Park is a mature second growth forest located in the Very Dry Maritime subzone (CWHxm) of the Coastal Western Hemlock biogeoclimatic zone. The park provides refuge for wildlife and recreational users alike, and contains important upland and riparian forest habitats, as well as permanent and ephemeral wetlands along the north side of the Puntledge River (see Figure 1).

The Puntledge River Basin forms the heart of the Comox Valley. It is composed of very rugged mountains with snowpack and glaciers feeding freshwater into the Comox Lake reservoir. The headwaters of both the Puntledge and Cruikshank Rivers form the origin of this watershed catchment area and are located in both the protected Strathcona Provincial Park and on private managed forest land with significant deforestation. The sole drainage of this deep reservoir system is the Puntledge River. Productivity within the Puntledge

River has been impacted over time by hydroelectric power generation, mass freshwater extraction, deforestation and increasing rural-residential development.

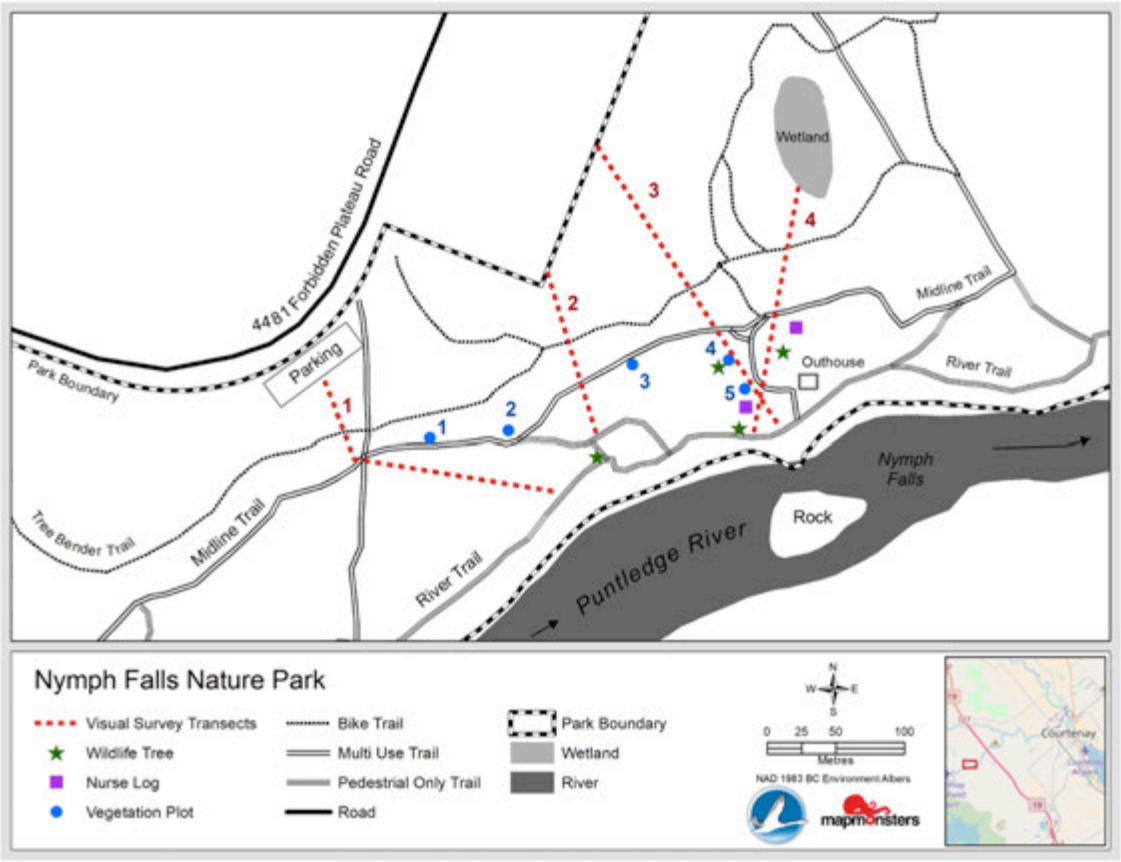


Figure 1. The Study Area in Nymph Falls Nature Park.

2.0 METHODS

A bio-inventory (or biophysical assessment) is used to account for the ecological condition of an area at a particular time and determine the scope of the impact(s) of a proposed development. It contributes to a baseline of ecological information (if none exists) or updates the baseline data if changes have occurred over time in an ecosystem. A bio-inventory is a primary step in the Environmental Impact Assessment (EIA) process that typically encompasses assessments of social, economic, heritage and health values related to a proposed development as well.

The field survey methods for this study were determined through the following steps:

- A preliminary visual survey of the study area in the field;
- A general review of ecological information found online for the Puntledge River Watershed;
- A desktop review of the Species-at-Risk (SAR) occurrence listings within a 5-km radius of the study area[1] (listed in Section 2.3 below);
- A compilation of standardized protocols for field inventories to characterize upland and riparian forest habitats and survey methods for the target SARs (refer to Section 2.4);

2.1 Preliminary Field Survey:

A preliminary survey of the study area was conducted prior to the start of field sampling to identify sensitive habitat features and form an overview assessment of the habitat type(s) and condition. This initial field work helped to form appropriate field sampling methods given the time constraints for this bio-inventory, the standardized approaches for detecting presence of listed SARs.

2.2 Target Wildlife Species:

The following target species were determined as possibly occurring within the study area given the upland and riparian forest habitat types identified in the preliminary field survey and the CDC SAR *known occurrence* data found near the park. Wildlife species without SAR status were not excluded from the field survey but encounters with them were recorded as incidental only.

a. ***Northern Redlegged frog*** (*Rana aurora*): provincially-listed as Special Concern (**blue-list**); federally-listed as Special Concern.

[1] Conservation Data Centre BC Species and Ecosystems Explorer (http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/species-and-ecosystems-explorer) as retrieved in June, 2018.

b. ***Western Screech Owl*** (*Megascops kennicottii kennicottii*): provincially-listed as Special Concern (**blue-list**); federally-listed as Threatened.
c. ***Northern Goshawk*** (*Accipiter gentilis laingi*): provincially-listed as Endangered (**red-list**); federally-listed as Threatened.

2.2.1 Northern Red-legged Frog

The wetland habitat located within the park (refer to the Figure 1 above) appears to be a permanently wetted seep area with dense riparian vegetation. It was not assessed for condition or the presence of larval lentic amphibians due to a lack of access through thick vegetation and a lack of available survey time, but is assumed to provide potential breeding habitat for the Northern Red-legged frog.

This part of the field assessment involved four visual encounter surveys (Transect Lines #1-4 in Figure 1) through riparian and upland forest habitats (in conjunction with the bird nesting surveys) and was selected through reference to the BC Resources Information Standards Committee (RISC) *Inventory Methods for Pond-Breeding Amphibians and Painted Turtle document* (1998)[2]. Each of the four transect lines was set to span both riparian and upland forest habitats within the study (i.e., within 100-m of the proposed road development area), but with a random distance and bearing. The youth selected the direction (i.e., a compass bearing) randomly for these survey lines once a start position was determined and participated in the visual search after a description of the target species was given.

Visual encounter surveys are recommended for out-migrating adult Northern Red-legged frogs in early summer from wetland/pond habitats where breeding activity typically peaks in March/April in this region. Visual encounter surveys can determine amphibian presence in an area (but not species absence without further investigation) and can be evaluated for effectiveness based on the total survey effort (as measured by the number of surveyors/hour engaged in searching for target species). The effectiveness of this method is also dependent

[2] BC RISC Inventory Methods for Pond-Breeding Amphibians and Painted Turtle (https://www.for.gov.bc.ca/hts/risc/pubs/tebiodiv/pond/assets/pond.pdf) as retrieved in June-2018.

on the surveyor(s) experience and expertise in the detection and identification of the target species.

2.2.2 Western Screech Owl

The Western Screech owl is a small, nocturnal owl that has become rare on Vancouver Island, but is known to have historically inhabited upland and riparian forests in this region. It relies on the standing deadwood and snags for roosting and nesting within small tree cavities. These cavities can be difficult to observe from the ground if they are located high in the canopy in dense vegetation, making visual sampling somewhat unreliable. Direct sampling for this species is recommended but requires a call-playback technique at night that was outside the scope of this study.

As with the survey method used for detection of the Northern Red-legged frog, the line-transect method was employed to detect owl nests in tree cavities and/or sign of owl feeding (such as whitewash on tree trunks, and/or feathers, pellets and prey remains on the forest floor) during the daytime. This methodology followed the *Visual Searches* techniques outlined in the BC RISC *Inventory Methods for Owl Surveys* (2006)[3]. YER participants in this survey were encouraged to take time to quietly scan the forest during the transect study for wildlife trees (i.e., standing deadwood and snags) and then focus on these for sign of nesting or feeding by owls.

2.2.3 Northern Goshawk

Northern Goshawks use of forests is somewhat unique amongst raptors as they are adept hunters within dense forest habitats unlike most other species that rely on open areas to hunt. The Northern Goshawk population on Vancouver Island is declining rapidly as a result of widespread removal of old-growth forests and *veteran* trees that this species depends on for nesting.

A visual search method was used to spot Northern Goshawk nests (and nests of other raptors such as the Bald Eagle) in the canopy of veteran trees along the

[3] BC RISC Inventory Methods for Owl Surveys (2006) ftp://nris.mt.gov/Public/Maxell/Owl_Surveys/BC_Inventory_Methods_Owls_2006.pdf as retrieved in June-2018.

four transect lines established in the study area (Figure 1). Also, surveyors were asked to watch for signs of raptor feeding such as whitewash on tree trunks, and/or feathers, pellets and prey remains on the forest floor. This methodology followed techniques outlined in the BC RISC *Inventory Methods for Raptors* (2001)[4].

2.3 Vegetation Inventory:

Five vegetation plots (5-m x 5-m) form the baseline vegetation inventory in this study. Three of the plot locations were randomly selected in upland forest habitat off the Midline Trail that runs through the area proposed for road development. The remaining two plot locations were randomly selected within the riparian forest area near to where the viewing platform and public outhouse is proposed (refer to Figure 1 for plot locations).

The sample area for each plot was set beginning with a random point forming the first of four corners in a 5-m x 5-m square area delineated by stakes in the ground. The dimension of the square was set using a random bearing from the initial point and then setting the other corners in a counter-clockwise direction (see Appendix A for plot location details).

The vegetation inventory was made for three categories of plants: herbs, shrubs, and trees. The categories were stratified by height with herbs including plants < 2-m tall, shrubs in the 2-m – 5-m height category, and trees were those considered > 5-m tall. The species composition was recorded and percent groundcover by species was estimated in each 5-m x 5-m plot area (refer to Appendix B for a complete list of plant species identified in this inventory).

An additional tree density inventory was conducted by a Rapid Density Estimate method[5]. In this procedure, the distance to the three nearest coniferous and deciduous tree species were measured (in metres) and recorded from the plot centre, and an average distance calculated from these three values. The average spacing (in metres) for each category (coniferous or deciduous) was then plugged into a formula that calculates the number of stems per hectare. The accuracy of this method increases with increasing sample size in a given area. For

---

[4] BC RISC Inventory Methods for Raptors (2001) https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/standards-guidelines/risc/rapt_ml_v2.pdf as retrieved in June-2018.

[5] BC Hydro Transmission Line Vegetation Management: Site Characterization Procedure (1998).

this study, a sample size of five plots was possible given time and resource constraints (refer to Appendix C for a complete list of tree density data collected in this survey).

A Coarse Woody Debris (CWD) inventory was also conducted due to a large volume of CWD found within the study area of the park (Photo 6). The inventory followed a standard Simple Coarse Woody Debris Assessment method[6] that involved the establishment of a transect line (30-m length) in a random direction from the centre of each plot. A field tape was used to mark this line and all CWD touched by the tape with a diameter greater than 7.5-cm was measured and recorded for decay class (refer to Appendix D for a complete list of CWD data collected and for percentage estimates of nurse logs in each sample area).

3.0 RESULTS

3.1 Target Species

No target SAR species were detected in this field survey although valuable habitat required by these species was identified. This included several wildlife trees (i.e., live veteran or large standing deadwood trees) that may serve as owl or raptor nesting habitat (see Figure 1 and Photos 1 and 2), and several nurse logs (i.e., CWD of decay classes 4 and 5) that may serve as refuge for amphibians, small mammals and invertebrate organisms important in the forest ecosystem (Photo 3).

Incidentally, three Deer mice (*Peromyscus maniculatus*), a Bald eagle (*Haliaeetus leucocephalus*), and several unidentified passerine birds were observed in the study area, as well as an unidentified species of juvenile salmonid in a pool within the Puntledge River near Nymph Falls.

[6] Land Management Handbook No. 25: Field Manual for Describing Terrestrial Ecosystems (1998) https://www.for.gov.bc.ca/hfd/pubs/Docs/LMH/LMH25/Lmh25_ed1_(1998).pdf as retrieved in June-2018.

3.2 Vegetation Inventory

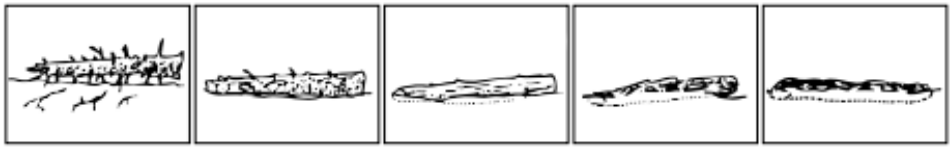
From observations made in the preliminary field survey, the condition of the upland forest (Photos 4 and 6) appeared to differ from the riparian forest (Photo 5) in two main ways:

1. The trees in the upland forest habitat are younger and more densely populated (i.e., a less mature forest ecosystem) than in the riparian forest habitat;
2. The upland forest has a higher density of CWD on the ground than the riparian forest.

The tree density calculations made in this study provide rough estimates of the abundance of coniferous and deciduous species in each forest habitat in the park (see Appendix C for a complete list of density data and calculated estimates), and provide some insight into the species composition and general age of the forest within the two habitats.

The data shows that the upland forest contains very few deciduous species (e.g., Red alder, Pacific dogwood, and Big-leaf maple) relative to coniferous species (e.g., Redcedar and Douglas fir) that were relatively abundant across all three plots. For the riparian forest, the same relationship exists but with a slightly higher abundance of deciduous species, namely Pacific dogwood and Big-leaf maple. It is possible that the relative densities of trees in the two forest types would show a greater difference with an increase in number of sample plots in each habitat.

A simple analysis of the CWD inventory data (Appendix D) was made to identify the presence of nurse logs in each forest habitat type. Nurse logs are defined as CWD with a diameter larger than 25-cm and a Decay Class of 4 or 5 (see Figure 2 below). This analysis revealed that there is no significant difference in the number of nurse logs between the two habitats. This result is not conclusive, however, given the small sample size within each habitat type.



	Class 1	Class 2	Class 3	Class 4	Class 5
Wood Texture	Hard	Sap rot (but still hard, thumbnail penetrates)	Advanced decay (spongy/large peices)	Extensive decay (crumbly-mushy)	Small pieces, soft portions
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging or broken	Fully settled on ground	Partly sunken
Branches	Hard branches with twigs	Soft branches	Branches/stubs absent	Absent	Absent
Bark	Firm	Loose	Trace	Absent	Absent
Wood Appearance	Fresh/recent	Colour fading	Fading colour	Light or brown	Reddish brown
Wood strength	Supports person	May not support person	Breaks easily. Pieces snap	Collapses with weight. Pieces do not snap	Feels firm like ground
Invading Roots	None	None	In sapwood	In heartwood	In heartwood

Figure 2. Coarse Woody Debris Decay Classification Chart[7].

3.3 Data Collection:

The following are examples of the data sheets used by the YERII team to collect Site Characterization and Vegetation Inventory data for each of the five plots.

[7] Land Management Handbook No. 25: Field Manual for Describing Terrestrial Ecosystems (1998) https://www.for.gov.bc.ca/hfd/pubs/Docs/LMH/LMH25/Lmh25_ed1_(1998).pdf as retrieved in June-2018.

Table 1. Site Characterization Data Sheet:

Nymph Falls Park Site Characterization		Date: July 4th, 2018	
Weather: Sun, partly cloudy			
Surveyors: Jade, Ethan, Wendy, Kayt			
Plot #: 5	Map #: 5		
Slope %: 10%	Aspect: NE		
Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Red alder	3.3	1	Deer mouse
N/A			
N/A			
Averages:			
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Redcedar	2.8	1	
Redcedar	3.4	1	
Redcedar	3.9	1	
Averages:	3.4	1	
Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
7.5	3	4.4	possibly burnt
9.2	3	3.8	
29.5	4	11.6	
26.6	5	6.7	
10.1	3	6.2	
23.2	2	30.7	
38.9	2	31.8	
26.2	4	2.9	
17.7	2	2.1	
22.1	2	3.7	
21.2	5	0.6	
32.0	5	4.8	
35.0	5	N/A	

Table 2. Vegetation Inventory Data Sheet:

Vegetation Inventory		Plot #: 5
Trees: Coniferous and Deciduous		
Deciduous species	% Cover	Habitat Notes:
Red alder	10	
Conifer species	% Cover	Habitat Notes:
Grand fir	10	
Red cedar	10	
Shrubs:		
Species	% Cover	Habitat Notes:
Red huckleberry	10	
Redcedar	15-20	
Herbs		
Species	% Cover	Habitat Notes:
Sword fern	50	
Trailing blackberry	3-4	
Trillium	1	
Vanilla leaf	3-5	
General Notes: More herbs include Twin flower (5%), Foamflower (1%), Bracken fern (1%), Licorice fern (1%).		

3.4 Field Survey Photos:

Photo 1. YER Coordinator Wendy Kotilla standing next to a valuable wildlife tree in the study area.

Photo 2. A standing deadwood Redcedar tree cavity started by excavations from woodpecker feeding activity.

Photo 3. A large nurse log located in the riparian forest adjacent to the proposed viewing platform and public outhouse facility.

Photo 4. An example of the young seral stage of the upland forest habitat and abundant CWD in the study area.

Photo 5. The YER Coordinator and youth participants conducting a vegetation inventory sample plot in the riparian forest habitat within the study area.

Photo 6. A YER youth participant conducting a CWD inventory in the upland forest of the study area.

Photo 7. Ethan Ashurst leading a public tour of Nymph Falls Nature Park.

Photo 8. YERII team Wendy Kotilla, Jade Antoine, Ethan Ashurst and Kayt Chambers.

.

3.5 Youth Program Results:

The two YERII participants, Jade Antoine and Ethan Ashurst, were immersed in a 5 day project to conduct ecological data collection as a bio-inventory in Nymph Falls Nature Park. After three days of field work to assess the flora and fauna of the park, the youth prepared for and delivered a guided public tour for fifteen people. The youth presented the Nymph Falls Nature Park bio-inventory in a professional manner and taught the tour participants about the ecological research necessary to manage our regional parks for the enjoyment of Comox Valley residents and visitors.

4.0 DISCUSSION

4.1 Visual Encounters:

Visual encounter surveys can determine presence of a species (such as an amphibian or a raptor) in an area but do not allow determination of absence without a more in depth investigation. The results of these surveys are evaluated based on the total survey effort (as measured by the number of surveyors per hour engaged in searching for target species).

4.1.1 Northern Redlegged Frog

The Northern Redlegged frog is a lentic amphibian. Lentic amphibians breed in wetlands and ephemeral pools rather than on land. They include a variety of frogs, toads, salamanders and newts. Amphibians play an important role in the food web of freshwater aquatic and terrestrial ecosystems by effectively acting as predators of invertebrates (such as zooplankton, insects and worms), while providing food for snakes, fish, mammals and birds of all sizes.

Lentic amphibians are negatively impacted by a loss of shade and CWD cover within their breeding and dispersal habitats, including ephemeral wetlands and other moist microhabitats within riparian forests. Elevated temperatures

associated with the large-scale land clearing can increase the susceptibility of amphibians to desiccation, which, in turn limits their dispersal (migration) and effectively isolates populations.

4.1.2 Western Screech-Owl

On Vancouver Island, the recent population decline in Western Screech owls is linked to displacement by the more powerful Barred Owls. Barred owls predate on Screech owls and out-compete them for nesting habitat and prey resources. As well, Western Screech owls are being impacted by increasing urbanization and deforestation activities in this region that reduces important roosting and nesting habitat for this species.

4.1.3 Northern Goshawk

Most Northern Goshawk nests are built in old deciduous and coniferous trees (i.e., veteran trees) and a healthy population requires a large, intact area of mature forest. The main threat to Northern Goshawks on Vancouver Island is the widespread loss of this type of habitat and the fragmentation of what remains due to urbanization and deforestation.

4.2 Vegetation Plots:

In general, older seral stage forest ecosystems on Vancouver Island contain a lower density of trees but a greater number of valuable wildlife habitats in the form of veteran and standing deadwood trees, as well as a greater number of large diameter nurse logs that provide important refuge for a variety of organisms.

A visual assessment of the upland forest gives the impression that it is younger than the riparian forest in the study area, with a higher density of younger trees and more CWD. The data from this study, however, shows that the tree species assemblages and densities within the two forest types is similar (refer to Appendix C). Both forest types exhibit a predominance of coniferous species with a slightly higher abundance of deciduous species in riparian habitat due probably to wider gaps in the overstory canopy when blow-down occurs.

It is important to note that the accuracy of this analysis would increase with a larger sample size in the form of a greater number of vegetation plots in both habitat types, and this increase in sample size may change the results of the study.

Finally, Laminated Root Rot is reported to exist in Nymph Falls Nature Park[8] and may be what is causing the abundance of young Douglas fir blow-down (i.e., small diameter CWD) within the park (see Photo 4). This forest disease is caused by a fungal pathogen (*Phellinus weirii*) that can thrive in second growth Redcedar and Douglas fir stands such as this one (although it was not confirmed within the study area). It weakens the rooting system of young trees, leading to a reduction in the canopy growth and photosynthetic capacity of a forest, followed by the death (i.e., blow down) of many trees similar to what is displayed in the study area. Regardless of the cause of the CWD abundance, a forest habitat is enhanced by the presence of decaying trees as they provide food (insects), security (cover), and thermal refuge for a variety of wildlife species within a forest.

5.0 CONCLUSIONS

This bio-inventory has determined that critical habitats for the three target SAR are unlikely to exist within the project area and the proposed development will not impact these species. Important wildlife habitats were identified in the study area, however, and these habitats require protection during construction. The scope of the potential impact(s) from construction will be mitigated with careful planning using standardized practices for construction management once design specifications are in place.

The main outcomes of this study are:

- The location of a number of important wildlife habitat features within the project area including wildlife trees (both veteran and standing deadwood), large nurse logs, and evidence of an ephemeral drainage area;

[8] Pers. Comm. Briand Allaert, CVRD Park Technician 03-May-2018.

- A baseline of ecological information for the park including a vegetation inventory, a CWD inventory, and estimates of tree density within both upland and riparian forest habitats;
- The identification of opportunities to mitigate impacts related to the proposed developments (refer to Section 6.0 below);
- Teaching the YER participants field sampling techniques involved in a forest bio-inventory and assisting them to prepare for and guide a public tour of the project.

6.0 RECOMMENDATIONS

As stated, this study has highlighted some important habitat features within the proposed development area of Nymph Falls Nature Park that require protection. These include:

1. Wildlife trees (i.e., veteran oldgrowth and large standing deadwood trees);
2. Medium to large sized Nurse logs (>25-cm diameter); and
3. Ephemeral drainages.

The following recommendations are measures to mitigate the potential negative impacts of the proposed development on these sensitive features.

A. Design the access road alignment to avoid the removal of veteran oldgrowth trees and large standing deadwood as these provide important bird habitat for raptors, owls, woodpeckers and passerines. Four wildlife trees were identified in this study (see Figure 1) that require protection. Others may be identified in the final road alignment survey.
B. Avoid causing unnecessary negative impacts to forest vegetation through careful delineation of the clearing area for the road construction and pre-planning for the dispersal of excess timbers in the forest if necessary.
C. Conduct the forest clearing and facilities construction a time period that will not impact habitats of fish or birds possibly residing in or adjacent to the park (i.e., adhere to appropriate work-timing windows).
D. Design and site the access road terminus and public outhouse locations so that they do not negatively impact pre-existing ephemeral surface drainages in riparian habitat of the proposed project area.
E. Construct the access road, public outhouse and viewing platform with stringent construction management and erosion and sediment control measures in place so that the footprint area is minimized (this is most critical for the construction of the viewing platform).

APPENDIX A

Vegetation Plot Locations within Nymph Falls Nature Park:

Plot #1 is located 71-m eastward along the Midline Trail beginning at the junction with the main access trail (service road) from the parking lot. The 5-m x 5-m plot was established on the north side of the trail with the CWD transect beginning at plot centre and running 30-m northwest into the forest.

Plot #2 is located 124-m eastward along the Midline Trail beginning at the junction with the main access trail (service road) from the parking lot. The 5-m x 5-m plot was established on the north side of the trail just past the first trail junction, with the CWD transect beginning at plot centre and running 30-m westward into the forest.

Plot #3 is located 193-m eastward along the Midline Trail beginning at the junction with the main access trail (service road) from the parking lot. The 5-m x 5-m plot was established on the south side of the trail with the CWD transect beginning at plot centre and running 30-m southeast into the forest.

Plot #4 is located 21-m northwest from Plot #5 (see location description below). The 5-m x 5-m plot was established to the west of the Midline Trail connector with the CWD transect beginning at plot centre and running 30-m northeast through the forest.

Plot #5 is located 49-m northwest along the secondary trail proposed for the outhouse development. It begins at the wooden bench adjacent to the proposed Nymph Falls viewing platform area. The 5-m x 5-m plot was established to the west of the Midline Trail connector with the CWD transect beginning at plot centre and running 30-m southwest through the forest.

APPENDIX B

Vegetation Inventory – Nymph Falls Nature Park

Native Deciduous and Coniferous Trees: > 5 metres

Douglas fir (*Pseudotsuga menziesii* ssp. *menziesii*)
Western Redcedar (*Thuja plicata*)
Big-leaf maple (*Acer macrophyllum*)
Red alder (*Alnus rubra*)
Pacific dogwood (*Cornus nuttallii*)

Native Shrubs: 2 – 5 metres

Western hemlock (*Tsuga heterophylla*)
Grand fir (*Abies grandis*)
Western Redcedar (*Thuja plicata*)
Red huckleberry (*Vaccinium parvifolium*)

Native Herbs (Low Ground Cover Plants): ≤ 2 metres

Dull Oregon grape (*Mahonia nervosa*)
Bracken fern (*Pteridium aquilinum*)
Trailing blackberry (*Rubus ursinus*)
Vanilla leaf (*Achlys triphylla*)
Salal (*Gualtheria shallon*)
Sword fern (*Polystichum munitum*)
Trillium (*Trillium grandiflorum*)
Sword fern (*Polystichum munitum*)
Starflower (*Trientalis borealis*)
Foamflower (*Tiarella trifoliata*)
Twinflower (*Linnaea borealis*)
False azalea (*Menziesia ferruginea*)
Baldhip rose (*Rosa gymnocarpa*)
Wild ginger (*Asarum caudatum*)
Moss sp.

APPENDIX C

Nymph Falls Nature Park Bio-Inventory Tree Density Estimation

Plot 1 Data:

Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Red alder	10.7	1	
Red alder	15.4	1	
Dogwood	23.6	1	
Averages:	16.6	1	
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Douglas fir	1.3	1	
Douglas fir	1.8	1	
Douglas fir	2.5	1	
Averages:	1.9	1	

Plot 2 Data:

Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Dogwood	16.2	1	
Averages:	16.2	1	
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Redcedar	2.2	1	
Redcedar	1.5	1	
Redcedar	2.6	1	
Averages:	2.1	1	

Plot 3 Data:

Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Dogwood	25	3	
Averages:	25	3	
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Redcedar	1.7	1	
Redcedar	1.3	1	
Redcedar	3.5	1	
Averages:	2.2	1	

Plot 4 Data:

Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Bigleaf Maple	12.4	1	
Bigleaf Maple	9.2	1	
Dogwood	9.8	1	
Averages:	10.5	1	
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Douglas fir	0.77	1	
Redcedar	1.69	1	
Douglas fir	1.22	1	
Averages:	1.23	1	

Plot 5 Data:

Tree Density: Rapid Estimation			
Deciduous species	Distance (m)	# stems	Wildlife Habitat Notes
Red alder	3.3	1	Deer mouse
N/A			
N/A			
Averages:	3.3	1	
Conifer species	Distance (m)	# stems	Wildlife Habitat Notes
Redcedar	2.8	1	
Redcedar	3.4	1	
Redcedar	3.9	1	
Averages:	3.4	1	

Density Estimates:

1. Riparian Forest (Plots 4 and 5)

a) Conifers = (999/ha + 9,533/ha)/2 = 5,266 stems/hectare
b) Deciduous = (0/ha + 100/ha)/2 = 50 stems/hectare

2. Upland Forest (Plots 1, 2, and 3)

a) Conifers = (3,199/ha + 2,618/ha + 2,386/ha)/3 = 2,734 stems/hectare
b) Deciduous = (50/ha + 0/ha + 0/ha)/3 = 17 stems/hectare

APPENDIX D

Nymph Falls Nature Park Bio-Inventory – Coarse Woody Debris (CWD) Inventory

Plot 1 Data:

Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
7.5	2	N/A	
8.0	2	7.8	
35.0	5	7.5	
8.1	2	7.9	
8.0	2	N/A	
27.0	5	4.3	
29.0	5	6.1	
30.0	5	17.4	
50.0	5	7.1	
26.0	1	4.3	
26.0	1	7.6	
29.0	4	3.0	

Plot 2 Data:

Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
16.0	2	10.0	
12.5	1	14.6	
32.0	5	3.3	
11.0	1	8.1	
15.0	3	5.3	
17.0	1	N/A	
11.0	1	N/A	
10.0	3	6.5	
10.0	2	12.7	

Plot 3 Data:

Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
11.0	4	4.0	
26.0	2	N/A	
15.0	4	2.3	
11.0	4	1.1	
14.0	4	1.9	
19.0	4	4.1	
13.5	2	15.4	
22.5	4	12.3	
12.0	3	17.6	
14.5	3	2.1	
13.0	4	2.0	
17.0	2	8.5	
14.0	4	1.9	
24.0	3	10.7	
7.5	3-4	7.4	

Plot 4 Data:

Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
34.0	2	64.3	
43.0	4	25.1	
29.0	4	23.3	
16.0	2	9.2	
30.0	5	9.1	
11.0	3	7.9	
12.0	2	N/A	
10.0	2	8.5	
8.5	2	5.3	
22.0	5	9.2	
11.5	4	0.9	
10.0	3	5.2	
43.0	5	8.3	
11.0	4	3.4	
20.0	5	11.9	
22.0	4	N/A	
15.0	4	16.3	
10.0	2-3	9.9	
18.0	4	20.7	
28.0	5	16.1	

Plot 5 Data:

Coarse Woody Debris (CWD) Inventory	(Note: CWD must be > 7.5 cm diameter)		
Diamter (cm)	Decay Class	Length (m)	Wildlife Habitat Notes
7.5	3	4.4	possibly burnt
9.2	3	3.8	
29.5	4	11.6	
26.6	5	6.7	
10.1	3	6.2	
23.2	2	30.7	
38.9	2	31.8	
26.2	4	2.9	
17.7	2	2.1	
22.1	2	3.7	
21.2	5	0.6	
32.0	5	4.8	
35.0	5	N/A	

Notes:

Nurse Logs are valuable CWD habitat within a forest. They are characterized as having a diameter of 25-cm or larger, and to be in Decay Classes 4 or 5.

Plot 1 (Upland Forest) – Approx. 50% of the CWD is providing valuable Nurse Log Habitat.

Plot 2 (Upland Forest) – Approx. 11% of the CWD is providing valuable Nurse Log Habitat.

Plot 3 (Upland Forest) – There were no valuable Nurse Logs in this sample.

Plot 4 (Riparian Forest) – Approx. 25% of the CWD is providing valuable Nurse Log Habitat.

Plot 5 (Riparian Forest) – Approx. 39% of the CWD is providing valuable Nurse Log Habitat.