PINECONE BURKE PARK
BOUNDARY ADJUSTMENT APPLICATION
Impact Assessment

December 2007

Run of River Power Inc.
Northwest Cascade Power Ltd.

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1.0 INTRODUCTION

Northwest Cascade Power Ltd. (NWCP) proposes the development of seven run-of-river water power projects on tributaries to the upper Pitt River, northeast of Vancouver, British Columbia (Figure 1). A transmission line is required to interconnect the Pitt River power generation facilities to the BC Transmission Corporation (BCTC) and BC Hydro electrical transmission and distribution systems. The planned interconnection point to the Provincial power grid is the Cheekeye electrical substation located at Squamish. The upper Pitt River projects are located on Crown lands adjacent to Garibaldi Provincial Park to the north, Golden Ears Provincial Park to the east, and Pinecone Burke Provincial Park to the west (Map 2).

NWCP proposes to construct the seven hydropower projects in the upper Pitt River Watershed during 2009/10 to 2015/16. The proposed transmission line which is the focus of this impact assessment report is planned to be a permanent facility which is to be constructed during summer, 2009.

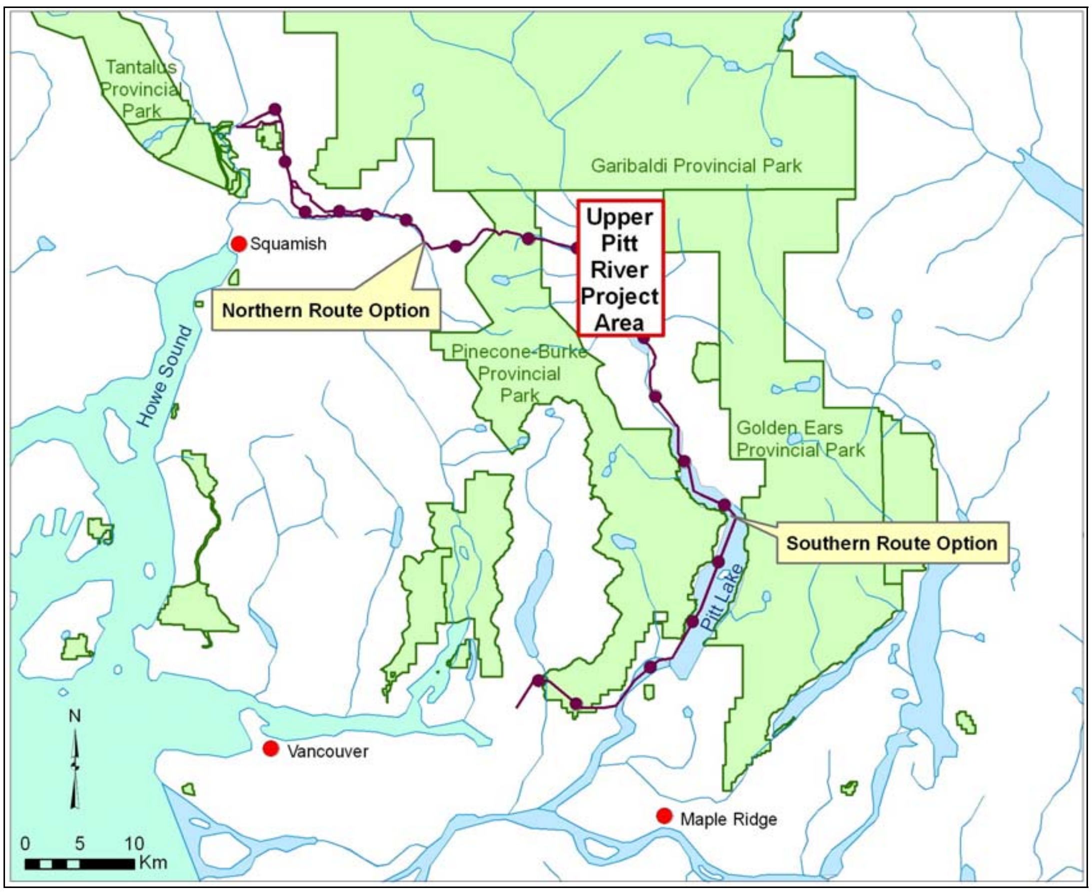

Figure 1. General location and proposed project area.

Note: all other project related maps are provided in Tab 4.

Three transmission route options were identified for the interconnection, two of which traverse Pinecone Burke Provincial Park and a third which was deemed not technically feasible. The comparison of route options is reported separately (Redden et al. 2007). This report assesses the potential environmental effects of the proposed transmission line through Pinecone Burke Provincial Park.

The regulatory and policy requirements which provide for consideration of adjustment to Provincial park boundaries are outlined in the BC Parks document entitled: Provincial Park Boundary Adjustment Policy Process and Guidelines (approved July 26, 2004). The guidelines were prepared to facilitate reviews of development applications that require park boundary adjustments, justified based on the developments' contributions to the provincial economy and the ability to mitigate the proposed project impacts to the environmental and recreational values within the park.

In addition to the park boundary adjustment guidelines the BC Parks Impact Assessment Process, Part 2 User's Guide (MoELP and BC Parks, April 1999) has been utilized in the preparation of this report. The location of the project and related transmission corridors proposed are shown in Map 2.

1.1 Project Proponent

NWCP is a subsidiary of Run of River Power Inc. (ROR). ROR has three proposed hydropower projects in the Mamquam River watershed, and plans to use the same transmission line infrastructure for these projects as for the upper Pitt River projects. ROR also owns Rockford Energy, which operates the Brandywine Creek hydropower project near Whistler.

1.2 Study Scope

This impact assessment provides technical information related to the proposed park boundary adjustment. The study scope is limited to consideration of the proposed 230 kV transmission line associated with the interconnection to the provincial grid, with most detail focused on the area within Pinecone Burke Provincial Park.

The entire hydropower project is to be reviewed in detail through the environmental assessment certificate process under the British Columbia Environmental Assessment Act (BCEAA). The Environmental Assessment Office has issued an order under Section 10 of BCEAA requiring an environmental assessment certificate for the proposed project, and the BCEAA process is proceeding simultaneously with the park boundary adjustment application process.

BC Parks is part of the Environmental Stewardship Division (ESD) of BC Ministry of Environment (MoE). The ESD is included in the multi-agency working group for the BCEAA process and has been involved in establishing the terms of reference for the overall project application. As BC Parks will be reviewing all the other components (i.e., those located outside of Pinecone Burke Provincial Park) of the proposed hydropower project through the BCEAA process, these aspects are not included in the scope of this impact assessment.

The application for a park boundary adjustment proposes the removal of approximately 70 ha from the park for the transmission line corridor. This alignment would subsequently be designated a Protected Area and be managed under a Park Use Permit. The requested area for the corridor is approximately 49 ha larger than that which will be occupied by the transmission line in order to ensure that any adjustments to the line location during construction will remain within the designated area. The final footprint required for the transmission corridor is 21 ha, and it is likely that BC Parks will elect to return the 49 ha portion of the Protected Area not occupied by the transmission line back into the Park after the transmission line has been constructed.

As the placement of structures is often adjusted during construction to properly address site-specific conditions, it is a standard procedure encouraged by Provincial authorities that applications for developments proposed on Crown land initially identify an area larger than required by the development, and that the boundaries of such areas are finalized to reflect the actual use of Crown land after construction.

The assessment of impacts is specific to the ~ 21 ha footprint of the project, as this is the extent of the proposed development.

1.3 Need for the Project & Public Interest

The proposal for the transmission line route to cross the park arises because the upper Pitt River watershed is surrounded by provincial parks on three sides and by the Pitt Lake and Pitt River to the south (Figure 1). A comparative evaluation of transmission line route options determined that the proposed route is the preferred route in terms of environmental, social and economic criteria (Redden et al. 2007; Tab 8).

The feasibility studies of potential transmission line route options found that there is no feasible alternative to avoid a park crossing, and as such the project will not proceed without a park boundary adjustment.

The upper Pitt River Waterpower Project is proposed in response to the initiatives of the BC Government and BC Hydro for the creation of new electricity generation capacity in the Province. The electricity that the project will generate is to be sold to BC Hydro under long term contract.

BC Hydro estimates that the demand for electricity in the province will increase 25 % to 40 % over the next 20 years. In 2006, BC imported 15 % of its domestic power requirements to satisfy demand and BC Hydro estimates that over the next 20 years 45 % of BC's energy could be imported.

Gas and coal derived electrical energy presently make up the bulk of the electrical energy imported for use in British Columbia. These are non-renewable, polluting energy sources whose power generation facilities emit greenhouse gases, considered the major contributing factor to global climate change and related negative environmental impacts. The BC Ministry of Water, Land and Air Protection documented the significant negative impacts of climate change on the Provincial environment, human health and natural resources (Indicators of Climate Change for British Columbia, 2002). In response to the existing and forecasted impacts of global climate change on BC's resources and economy, in 2004, the BC Government produced a climate change action plan (Weather, Climate and the Future: BC's Plan). The plan set out the goal to meet 50 % of new electricity demand with clean sources, including hydropower.

The Provincial Government has determined that all new electricity generation in the Province is to be provided by the private sector. In response, BC Hydro has initiated processes to acquire new generation from independent power producers (IPP's) to help address the predicted energy supply shortfall. IPP's such as the run-of-river power projects proposed for the upper Pitt River provide a 'green' and sustainable means of generating the electricity to meet British Columbia's needs. It is in the public interest to develop this project and other new sustainable sources of renewable, non-polluting electricity generation in the Province.

The 2007 Provincial Throne Speech set out a commitment for the Province's energy plan to require that 90 % of B.C.'s electricity come from clean, renewable sources, and stated that all electricity produced in B.C. will be required to have net zero greenhouse gas emissions by 2016.

The proposed NWCP projects will have a combined installed capacity of approximately 180 MW, and will generate an estimated 557 GWh of renewable energy annually. The projects would generate enough clean, 'green' electricity to supply more than 55,700 homes.

The energy produced by the proposed project will be equivalent to a reduction of 200,520 tonnes CO_2/yr compared with new combined cycle gas turbine generation, or 476,235 tonnes CO_2/yr compared with coal fired turbine generation. Projects such as the one proposed for the upper Pitt River are important to attaining the Provincial government's targets to reduce greenhouse gas emissions and to generate electricity from clean, renewable sources.

The application for a park boundary adjustment proposes to designate approximately 70 ha as Protected Area, within which a final 21 ha area will be used for the transmission line corridor, with the remaining 49 ha portion of the Protected Area being returned to the Park after construction.

In addition , 492 ha is proposed to be added to the park that include areas that the Province has identified as being suitable for goat winter range and grizzly bear habitat (Map 6). These areas are non-contributing to the regional timber supply, and therefore can become Class A parkland without resulting in a negative impact to the Provincial economy or forest industry. If accepted as proposed, the final park boundary adjustment will result in a net increase of approximately 471 ha in the area of Pinecone Burke Provincial Park.

Due to a lack of access and facilities, there is presently little recreational use of the Park in the vicinity of the proposed project. The proposed hydropower and transmission line project components will provide limited opportunities to improve access to the Park and provide supporting facilities for hiker. This aspect would be subject to a recreation and management plan acceptable by BC Parks and the Katzie First Nation.

NWCP is committed to providing benefits to the park and park uses, including building or contributing to the cost of facilities, and monitoring and research to support park planning.

1.4 The Provincial Park Boundary Adjustment Process

The proposed transmission line corridor is not permissible under the *Park Act*. The Minister of Environment will consider such proposals where the public interest may warrant modifying park boundaries to remove the affected area from the park. Since 2000, the Ministry has had a policy in place outlining how such proposals will be reviewed. In 2004, Government updated that policy, and issued the *Provincial Park Boundary Adjustment Policy, Process and Guidelines* (the Policy).

The Policy sets out guiding principles for evaluating proposals such as this. Legislative decisions to approve such boundary adjustments are based on the proponent's ability to demonstrate that:

- Alternatives to avoid the Park have been considered (Section 2)
- Overall economic benefits to the Province have been documented (Section 3 of this report)
- Social and environmental impacts have been documented (Sections 4 and 6, respectively)
- Mitigation and restoration have been identified (Section 4)
- First Nations have been adequately consulted (Section 7)
- Local community has been consulted (Section 8)

Conclusions and recommendations associated with this review are presented in Section 9.

1.5 Study Terms of Reference

The terms of reference (TOR) for this impact assessment were developed in consultation with BC Parks through a series of meetings held during fall 2006 through fall, 2007. BC Parks indicated that a (Level 3) Full Impact Assessment Report is required for the proposed transmission line crossing of Pinecone Burke Provincial Park and the park boundary adjustment application. This report is structured in accordance with the table of contents that was vetted by BC Parks as the framework for this EIA. The terms of reference also includes the BC Parks Impact Assessment Process, Part 2 User's Guide (MoELP and BC Parks, April 1999), and the 2004 Provincial Park Boundary Adjustment Policy, Process and Guidelines.

2.0 PROJECT ALTERNATIVES

The purpose of assessing project alternatives is to determine whether an adjustment to the park boundary can be avoided, and also to select a preferred electricity transmission line route which:

- minimizes environmental effects along the entire corridor (generally studied at a conceptual planning level utilizing 1:50,000 scale mapping);
- minimizes environmental effects through Pinecone Burke Provincial Park (studied at a functional level assessment utilizing 1:20,000 scale mapping and field investigations); and
- is feasible based on cost and technical criteria.

The interconnection to the provincial electricity grid is a critical technical issue in the selection of transmission route options.

2.1 Route Option Alternatives

Three alternative route options were identified: two of these were to the south of the project area and would utilize a combination of overhead transmission lines and a submarine cable. These options would interconnect with the Provincial power grid at either the Maple Ridge or the Coast Median substation. The third option was an overhead transmission line travelling west to interconnect at the Cheekye substation near Squamish.

The option to interconnect at Maple Ridge had been identified several years ago when the hydropower project was first proposed. The initial proposal was for a project with significantly less power generation. It is not known whether it would have been technically viable at that time to interconnect the smaller voltage project at Maple Ridge. The Maple Ridge Substation is a 69/25 kV substation which does not have the capacity to receive the 230 kV transmission line. Previous studies by the British Columbia Transmission Corporation (BCTC) determined that it was not possible to expand the local load of the substation and there is no room to add equipment in the substation (C. Surdu, P.Eng., BCTC, Pers. Comm.). As the interconnection is not technically feasible, this route option was subsequently eliminated from the evaluation.

The remaining two route options, defined as the Northern Route (Option 1) and Southern Route (Option 2) traverse the Pinecone Burke Provincial Park and require a Provincial Park Boundary Adjustment (Map 1; Tab 4). For the purpose of this review options are assessed as per requirements outlined in the BC Parks Boundary Adjustment Guidelines and BC Parks Impact Assessment Process, Part 2 User's Guide (MoELP and BC Parks, April 1999).

2.2 Route Option Comparison and Route Selection

The two transmission line route options were evaluated on the basis of the following criteria:

- First Nations considerations
- Environmentally sensitive areas
- Protected areas
- Wildlife and wildlife habitat within Pinecone Burke Park
- Provincially red and blue listed species and ecological communities
- Species at Risk Act (SARA) listed species
- Fish and fish habitat
- Tourism / recreation impacts
- Socio-economic factors
- Visual quality impacts
- Technical Feasibility
- Capital Cost

The comparison of the two transmission line route options is provided in detail in the report, *upper Pitt River Water Power Project - Comparative Evaluation of Transmission Route Options* (Redden et al. 2007). The scope of the comparative assessment included the entire length of the transmission routes, with additional detailed focused on the proposed park crossings.

The comparative analysis of the two routes concluded that the Northern Route is more suitable, with fewer constraints, lower cost and lesser potential for negative environmental and socio-economic impacts (Redden et al. 2007; Tab 8).

3.0 ECONOMIC BENEFITS

The economic benefits of the proposed upper Pitt River waterpower project were determined using the British Columbia Input Output Model (BCIOM). The BCIOM method and results are presented in Appendix A, and are summarized below.

3.1 British Columbia Input Output Model

The BCIOM is derived from 2001 Inter-Provincial Input-Output tables developed by Statistics Canada and includes details on 727 commodities, 300 industries, and 170 ‘final demand’ categories, which are used as inputs into computer algorithms developed to undertake calculations. It can be used to predict how an increase or decrease in demand for the products of one industry will have an impact on other industries and therefore on the entire economy.

The BCIOM traces the impacts of a particular economic activity on other sectors of the economy and provides statistical economic results of that activity. Information on commodities consumed and produced by each industry is combined into a single model of the economy, and is queried to determine the economic activity generated by spending in particular sectors. The identified relationship between goods and services in the economy is utilized to generate an estimate of the overall economic impact of this spending. Impacts on the economy are defined based on three types of impacts: direct, indirect and induced impacts (Appendix A).

The results of the BCIOM are summarized below. The methods, assumptions and detailed results are presented in Appendix A.

3.2 Construction Costs: Model Input Data

The input data used to run the BCIOM are based on construction estimates provided by NWCP. The inputs utilized in the BCIOM run, the assumptions and the results are provided in detail in Appendix A and are summarized in Table 1. The input variables consist of the commodities utilized in construction and clarifies whether such commodities were purchased from a manufacture, wholesaler or retailer and whether or not the commodities were produced in BC, all of which impact on the results of the model. Estimated commodity purchases totalled $350M (Appendix A).

3.3 Estimated Benefits

The major economic benefits resulting from the creation of the power production facilities modeled are provided in detail in (Appendix A). Estimated economic benefits were valued at $156M, including $26.8M in taxes (Appendix A).

Additional benefits include an estimated $5.3M paid to the Province annually for water license and land tenure fees.

3.4 Employment Impacts

Estimated benefits include 1959 person years of employment. The distribution of employment impacts by sector of the economy are presented in Table 1 below.

Table 1. Distribution of employment among sectors.

Economic Sector	**Employment (person years)**
Construction	161
Manufacturing	136
Retail Trade	131
Transportation & Warehousing	216
Finance, Insurance & Real Estate	180
Professional, Scientific & Technical Services	572
Accommodation & Food Services	182
Other Industries	372
Total	1950

As illustrated the person years of employment is distributed throughout the economy and represents a significant contribution as a result of this project.

3.5 Summary of Economic Benefits

Utilizing the BCIOM the following benefits are anticipated with the construction of the NWCP projects:

1950 person years of employment will be created consisting of:

- 1,487 indirect and induced person years
- 463 induced person years

GDP at a factor cost will contribute $129.1 million consisting of:

- $100 million of direct and indirect impacts
- $29.1 million of induced impacts

$14.8 million in provincial taxes consisting of:

- $10.2 million in direct and indirect tax revenues
- $4.6 in induced tax revenues

$12 million in federal tax revenues consisting of:

- $ 8.1 million in direct and indirect tax revenues
- $ 3.9 million in induced tax revenues

Additional benefits not included in the BCIOM model include an estimated $5.3M paid to the Province annually for water license and land tenure fees.

4.0 ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impact assessment of the proposed 230 kV electrical transmission line alignment through Pinecone Burke Provincial Park includes the 4.56 km route across the park from the Steve Creek sub-basin in the upper Pitt River watershed to the Crawford Creek sub-basin in the Mamquam River watershed (Map 3). As indicated above, all other components of the proposed hydropower project are to be reviewed in detail through the environmental assessment certificate process under the British Columbia Environmental Assessment Act (BCEAA).

The environmental impact assessment methodology consists of the following steps:

- determine the preliminary route design and defining the study area (Section 4.1)
- establish baseline conditions within the study area (Section. 4.3)
- identify environmental constraints to the proposed project development and finalize the transmission route design in consideration of the constraints (Section 4.4)
- identify potential impacts and measures to avoid or reduce (mitigate) adverse impacts (Sec. 4.4 to 4.10)
- assess residual effects (Section 4.12)
- assess cumulative effects (Section 4.12)

4.1 Preliminary Route Design and Study Area

The comparative route assessment (Redden et al. 2007: Tab 8) determined that the northern route was the most suitable route. The general location of the proposed park crossing route through the pass between the Steve Creek sub-basin in the upper Pitt River watershed to the Crawford Creek sub-basin in the Mamquam River watershed was identified by the project study team in summer, 2006.

The preliminary route location was selected based on the following criteria:

- terrain - the pass was selected to avoid difficult mountainous terrain and associated hazards, visual impacts and high construction costs
- park crossing distance – the route crosses the park at its narrowest location

- shared infrastructure – the shortest route was selected between the proposed intake location at Steve Creek and the existing forest road in Crawford Creek.

The study area was defined as the Crawford-Steve Pass based on the location of the preliminary route location.

4.2 Park Formation and Park Management Planning

Pinecone Burke Provincial Park was declared a Class A park in 1995. In 1992 the area was declared a Protected Areas Strategy Category Two Site and a Study Team was formed to research the site and make recommendations regarding park formation. Three options were identified for the park area, and in 1994 the largest of the three (Option C) was selected based on eight votes from Study Team members: the remaining seven votes were split between two smaller park area options, neither of which included Crawford-Steve Pass where the proposed transmission line is to be located. BC Parks supported Option C, although the Environment and Lands sections of the Ministry of Environment, Lands and Parks, as well as BC MOF and BC MEMPR did not.

The Study Team noted that the larger park option *"would have a negative impact on any future plan to provide access to the upper Pitt Valley, if an access corridor is not part of a protected area Master Plan.*" As the park management planning process is not complete, Pinecone Burke Provincial Park is not zoned and the management plan has not been completed.

The Study Team did not identify any special features in the Crawford-Steve Pass. Special features that were identified included Burke Mountain Plateau, Widgeon Slough and Widgeon Lake, specific forests along Pitt Lake, the alpine area of Consolation Lakes, and old growth forests of DeBeck and Boise Creeks (Report of the Pinecone Lake – Burke Mountain Study Team. 1994).

The 1994 Report of the Pinecone Lake – Burke Mountain Study Team states *"the northern portion of the study area (Pinecone Lake, Homer Creek), though natural, only qualifies as wilderness in places, while other areas suffer from encroachment from logging from the east and west. The central section of the study area (Boise Creek, DeBeck Creek), however, harbours true wilderness landscapes. The headwaters of Boise, DeBeck and Mamquam/Indian River watersheds within the study area, combined with the upper Coquitlam drainage (outside the study area), form the main wilderness core."*

4.3 Baseline Conditions

As indicated above, the scope of this report is limited to consideration of the 230 kV transmission line within Pinecone Burke Provincial Park. The entire hydropower project including the transmission line route outside the park boundaries will be reviewed in detail through the environmental assessment certificate process under the BCEAA.

Baseline environmental conditions in the vicinity of the proposed transmission line corridor are described in detail in the *Baseline Ecological Assessment* (Toth et al. 2007: Appendix B). This includes information on aquatic and terrestrial ecosystems, and valued ecosystem components such as fish, wildlife, vegetation and ecological communities. A brief summary of the *Baseline Ecological Assessment* is provided below to characterize the ecology of the study area. The literature references and details are provided in Appendix B.

The proposed transmission line corridor is located in a low mountain pass which divides the Mamquam and upper Pitt River watersheds. Drainage on the east side of the pass flows to Steve Creek in the upper Pitt River watershed and drainage on the west side of the divide flows to Crawford Creek in the Mamquam River watershed. The 'Crawford-Steve Pass' is approximately 1300 m in elevation at its highest point and is bounded by Pinecone Peak (2027 m) to the south and Cotard Peak (1926 m) to the north. The area lies within the Southern Pacific Ranges of the Coast and Mountains Ecoprovince. The entire alignment of the proposed transmission line corridor within Pinecone Burke Provincial Park is located within the Mountain Hemlock (MHmm1) biogeoclimatic zone. The length of the proposed transmission corridor within the Park is approximately 4.56 km. The study area is located on the boundary between the Chilliwack and Squamish Forest Districts and Provincial Management Units 2-7 and 2-8.

The Pacific and Cascade Ranges Ecoregion is the southern most mountain range of the Coast Mountains in British Columbia. The mountains are characteristically high and rugged. The Southern Pacific Ranges Ecosection is an area of high rainfall on steep, rugged mountains located east of the Georgia Depression Ecoprovince.

The major climatic processes in the Southern Coast Mountains involve the arrival of frontal systems from the Pacific Ocean and the subsequent lifting of those systems over the coastal mountains. In higher areas, amabilis fir is the common co-dominant climax species with mountain hemlock and yellow cedar. Understory is typically dense with vaccinium species, salal, devil's club, ferns, foamflowers, and a thick moss layer. Avalanche chutes are covered with Sitka alder and moisture tolerant herbs.

The coastal subalpine climate of the Mountain Hemlock zone (MH) is characterized by short, cool summers, and long, cool wet winters, with heavy snow cover for several months. Mean annual temperature varies among the subzones from 0 to 5 ^{0}C. Mean annual precipitation varies from 1,700 to 5,000 mm, depending on elevation and aspect. The deep winter snow pack is slow to disappear, resulting in a short growing season. Mountain hemlock, amabilis fir and yellow cedar are the most common tree species in the zone. Forests are not continuous in the MH zone and are largely confined to lower elevations. With increasing elevation the forest thins out to subalpine parkland, with trees in isolated clumps, irregular small patches, and along ridge crests where the snow melts earlier. The tree clumps form a mosaic with subalpine heath, meadow, and fen vegetation.

Soils in the Southern Coast Mountains are strongly weathered, typically acidic, reddish in colour, and rich in aluminum, iron and organic matter. Soils within the study area are described by the Soil Landscapes of Canada as Ferro-Humic Podzolic soils on sands of colluvial deposition.

There were three broad ecotypes identified within the proposed transmission route through the park. These included a shrub and herb fen wetland area at the eastern boundary of the park on Steve Creek, mountain hemlock / amabilis fir dominated old growth forest stands, and a subalpine mountain hemlock / yellow cedar – mountain heather association in the upper elevation areas of the study area. Compatible vegetation areas (i.e., areas where vegetation is unlikely to interfere with power line integrity and therefore not requiring maintenance) were estimated to account for up to 48 % of the northern park crossing based on vegetation resources inventory (VRI). More accurate ecosystem mapping subsequently determined that compatible vegetation coverage was closer to 31 % of the park corridor.

The large open fen wetland occupies most of the valley bottom on the Steve Creek side of the proposed transmission route. The wetland feature was classified as a narrow-leaved cotton-grass – peat moss (Wf50) wetland. The fen is dominated by sedges, grasses and brown mosses with Indian hellebore, marsh cinquefoil, sticky false asphodel, western tea-berry, western bog-laurel, and leatherleaf saxifrage identifiable herbaceous species. Steve Creek meanders through this fen area providing a secondary set of site characteristics associated with the salix sp. and Sitka alder shrub dominated riparian area of the stream. Old oxbows and open water ponds associated with abandoned or relic stream channels were prevalent throughout the fen area, with evidence of recent flooding sheet flows over some areas, suggesting that areas of the fen are occasionally inundated. Tree species within the fen area consisted of occasional stunted mountain hemlock, yellow cedar, and amabilis fir.

An analysis of the forest cover along the proposed transmission route indicated that it was comprised of old growth mountain hemlock and amabilis fir dominated stands of variable densities. Draft old growth management areas are present in the Crawford-Steve Pass. The pass has not been logged. Most timber stands were comprised of a clumped distribution of trees with increasingly open canopies with elevation gained. Yellow cedar within stands also became more prevalent within stands with elevation gained. Coarse woody debris and snags were locally abundant in some stands. The shrub layer coverage was high in open stands and subalpine parkland and was dominated by vaccinium sp., false azalea, pink mountain heather, and occasional white-flowered rhododendron. Herb layer coverage was low within forested stands except along streams. Herb cover was high in open fen / seepage areas and was comprised predominantly of Indian hellebore, sitka valerian, brewer's mitrewort, stream violet, partridgefoot and leatherleaf saxifrage (Toth et al. 2007: Appendix B).

Wildlife utilization of the Crawford-Steve Pass is low and generally limited to seasonal migrations. Large mammals potentially occurring or known to occur in the pass include black-tailed deer, black bear, grizzly bear, elk, mountain goat, coyote, wolverine and cougar Toth et al. (2007: Appendix B).

4.4 Final Route Design and Proposed Boundary Adjustment

The first and possibly most important step in minimizing potential environmental impacts is the process of selecting the location of the project infrastructure and resulting environmental 'footprint'. This process initially identified the Northern Route as the most suitable, and was then applied again at a more detailed level of study for the park crossing. Four possible routes through the Crawford-Steve Pass were evaluated based on the environmental features within the study area to select the final transmission line location through Pinecone Burke Park. The four route options and the constraints considered are shown in Map 16.

To minimize potential environmental impacts the route should be as short as possible, and where possible it should route should avoid unstable terrain and avalanche hazards, and travel through areas where the short and long-term disruption and impacts to terrestrial and aquatic ecosystems are minimal. As determined in consultation with BC Parks, the criteria for route selection were:

- A shorter route is preferred over a longer route
- The route should address terrain and avalanche risks
- The route should avoid disturbance to the Steve Creek wetland
- A route through thinly treed areas is preferred to one through heavily forested or old growth areas, because less trees need to be removed
- A route through areas vegetated by herb and shrub layers is preferred to a forested area as less trees need to be removed
- A route over rock is preferred over a route through vegetated areas as bare rock has the least potential for environmental values
- The route design should consider visual quality and recreational aspects
- Environmental criteria outweigh visual quality and recreational criteria.

In addition to the social and environmental criteria listed above, the Katzie First Nation added the criterion that the transmission line park crossing should not create new access for motorized vehicles between the Mamquam River and Pitt River watersheds.

Some trade-offs are required for route selection: for example it may be necessary to travel through a forested area to avoid an area with high avalanche risk. Another trade-off to consider is that of environmental versus recreational impacts. For example, depending on the vantage point, a transmission line through an open and exposed area may have more of a visual impact than one through a mature forest stand. Conversely, from another vantage point the ROW through a forested area may be more visible than the transmission line through a naturally open area. While the visual impact will depend on the presence and location of the viewer, the environmental impact will not. This review considers both aspects, but considers environmental impacts to be a higher priority because (i) they occur irregardless of the presence and location of someone viewing the landscape, and (ii) given the location of the transmission line and very low recreational use of the area, visual impacts are likely to occur infrequently. Nonetheless, the route consideration eliminated the height of land above the pass as this would have maximized the visual impact of the transmission line. The detailed visual impact assessment is provided in Tab 6.

Route selection considerations included avoiding significant wildlife habitat features; however field studies did not locate any nests, dens or critical wildlife habitats (Appendix B). Due to the deep and persistent snow pack (measured at > 4.5 m in April 2007) wildlife habitat use of the high elevation pass is low and generally limited to late summer and early fall, outside of breeding seasons.

Map 16 shows the primary constraints considered in locating the transmission line crossing of the park. These constraints are (i) terrain and avalanche hazards, (ii) the Steve Creek wetland, and (iii) old growth forest stands. This figure shows that route selection requires consideration of trade-offs between constraints. Terrain constraints were considered most important as the integrity of the transmission line is paramount and interruptions to the line would result in disturbance resulting from maintenance requirements. Avoiding the Steve Creek wetland was identified as an important consideration by BC Parks.

The transmission line route and structures were designed by Lex Engineering, and were based on consideration of snow / avalanche risk and terrain hazard assessments completed by Baumann Engineering (Tab 5). The recommended transmission route is detailed in Tab 5. Lex Engineering has provided detailed mapping of the proposed transmission line. They have also specified a larger area within which it is certain that the line can be constructed, and this larger area is proposed to be removed from Pinecone Burke Park. The 70 ha area requested to be excluded from the park is shown as a red line in Map 3 (Tab 4). The UTM coordinates for the four corners of this polygon are listed in Table 2, below.

Table 2. Coordinates of corners of boundary adjustment polygon.

Point	UTM_Zone	UTM_X	UTM_Y
NE	10	516393.7367	5505054.598
SE	10	516395.9246	5504758.554
SW	10	512149.1651	5505754.405
NW	10	512162.1365	5505830.296

The proposed area to be removed from the park is 70 ha, which has deliberately been made larger than the 21 ha required for construction to ensure that any necessary adjustments to the location of structures during construction remains within the legally defined area. At the conclusion of transmission line construction it is recommended that the line be surveyed, and the 49 ha area that was removed from the park which is not occupied by transmission line be retuned to the park.

4.5 Transmission Line Pole Structure Selection

Assessment of environmental and recreational impacts includes consideration of the types of structures to be used for the proposed transmission line. It was determined early on in discussion with BC Parks that wooden pole structures are preferred as metal structures are not as aesthetically pleasing and were considered to have a more negative impact to visual quality and recreation. It was also determined that fewer, taller structures are preferred to a greater number of shorter pole structures. This is another example of the trade-offs considered between visual quality and environmental impacts.

Taller structures enable a greater span distance between poles, reducing the number of structures required and thereby reducing the physical footprint of the transmission line and the extent of disturbance during construction. The longer spanning, taller structures also reduce the exposure and risk to terrain and avalanche hazards. As such, taller poles were deemed most appropriate.

Recommendation: Taller poles are recommended to minimize the number of structures required, reduce the construction footprint, and reduce the risks from terrain and avalanche hazards.

4.6 Transmission Line Construction Methods

Three approaches to transmission line construction through the park have been evaluated as part of this assessment: (i) aerial construction of overhead lines, (ii) conventional (ground based) construction of overhead lines, and (iii) conventional construction of a buried transmission line.

The footprint impacts of the three construction methods include permanent structures and tree removal for line protection. Direct, quantitative comparisons are difficult as permanent structures such as roads and poles remove area from biological production, while areas where tree removal is necessary to protect the transmission line will support other types of vegetation. As with other aspects of project design considerations, the selection of construction methods entails trade-offs to recommend an approach that best meets the objectives for managing parks and protected areas.

Environmental impacts will vary by ecosystem type. For example, it may make no difference what the ROW width is through open rock, herb or shrub layer ecosystems, as these areas support few or no trees that grow to the height of concern for power lines. Conversely, the ROW width is important in a mature forest stand, as it will dictate the number of trees that need to be removed.

Given that the ROW can be altered by tree removal yet still provide beneficial wildlife habitats, tree removal is generally considered to have a lower net impact than road construction. Thus, ground based and road construction along the park crossing route is considered to have a greater footprint impact than ROW tree removal.

4.6.1 Overhead Transmission: Aerial Construction

This option would use helicopters to fly in structures, materials, equipment and personnel for construction and would eliminate the need to build access roads along the transmission corridor. Construction would require steel corrugated culverts to be set vertically in excavated holes to secure the wooden poles. Construction would require the transmission pole's to be set at a depth of 2.5 m to 3 m in soil or 1.7 m to 2 m in rock (Lex Engineering 2007: Tab 5).

Excavation of the holes to secure the poles would be done using a rubber-tired excavator. The equipment would be slung to each pole site by helicopter, minimizing the amount of ground disturbance. Temporary site disturbance would be limited to a small area (perhaps 400 m^2) at each structure site during construction, and permanent habitat loss should be limited to < 10 m^2 at each site where the pole structures are situated.

The pole assembly would likely take place at a nearby staging area located outside the park, and then the completed structure would be set and raised into place by the helicopter and backfilled by hand or with the aid of the backhoe.

The primary potential environmental impacts related to construction include the disturbance and removal of vegetation and soils associated with the clearing of the ROW, and a relatively small amount of disturbance at each pole site. The falling crew for the ROW clearing would not have an access road and would need to walk in to the site or be transported via helicopter.

ROW clearing will result in the temporary or permanent alteration or loss of terrestrial habitat. There is always the potential for direct mortality of some wildlife species during vegetation removal; however this potential is relatively low given the low wildlife use of the pass. Helicopter based construction will generate considerable noise and may result in wildlife disturbance and temporary avoidance of the construction area.

During construction there is the potential for workers, vehicles and equipment to act as vectors for seed dispersal. This could result in the introduction of non-native or nuisance plant species into the high elevation park ecosystems, which could negatively impact vegetation and wildlife habitat values. This potential impact is greatest where natural vegetation has been removed and soils are exposed.

Construction activities present various opportunities for potential negative impacts to environmental quality. These include vehicle and equipment re-fuelling, servicing and operation, dust, noise and exhaust emissions, and the generation and handling of hazardous and domestic wastes and garbage. The presence of workers and operating equipment always creates the potential for a wildfire to be initiated.

The surrounding watersheds are dominated by forested ecosystems. Large wetlands and alpine habitats are less abundant, and are important to maintaining biodiversity. Overall, construction via helicopter is considered to have the lowest environmental impact on these ecosystems because it entails by far the least amount of ground disturbance and habitat loss. Using this method, except for tree removal, all of the ground between poles will be undisturbed, resulting in very little permanent habitat loss. This method is also considered to have the lowest potential for the introduction of invasive or nuisance plant species spread by machinery and vehicles, which is important to maintaining the ecological integrity of these high elevation ecosystems. Compatible vegetation areas (i.e., areas where vegetation is unlikely to interfere with power line integrity and therefore not requiring maintenance) are estimated to account for 31 % of the proposed park corridor.

Construction impacts relate to the duration and extent of disturbance resulting from construction activity. Helicopter construction will be the least disruptive to the ground and will require the least amount of post-construction remediation, restoration and re-vegetation. The noise impacts of helicopter construction will likely be greater than conventional construction of overhead lines, but this may result in less noise than the blasting and extensive construction required for a buried transmission line and access road.

Helicopter installation of overhead lines has the least potential to create new access for recreational vehicles, thereby further reducing the potential for impacts related to increased hunting pressure, wildlife disturbance, invasive plant species introduction and the various other types of environmental degradation that may arise as a result of recreational vehicle use and access.

The duration of construction will be the shortest for helicopter based installation, which will also have the least amount of heavy equipment construction and therefore, should have the least risk for wildfire, fuel handling and use, waste management and other construction related environmental aspects. Maintenance access once the line is in operation would be via helicopter.

4.6.2 Overhead Transmission: Conventional Construction

Construction would require steel corrugated culverts to be set vertically in excavated holes to secure the wooden poles. Construction would require the transmission pole's to be set at a depth of 2.5 m to 3 m in soil or 1.7 m to 2 m in rock (Lex Engineering 2007: Tab 5).

Excavating the holes for the culverts would be completed by machine, preferably a rubber tired backhoe. Tracked excavators may be required for excavation on slopes. The footprint effects to the ground would include the space occupied by the structures and the area disturbed during installation. An excavator would be required to dig the holes and trucks would be used to transport the poles and conductors to each pole site. The pole assembly would take place on the ground at the site, and then the pole would be set and raised into place by the backhoe.

A tote road or trail would be constructed for the equipment to gain access to each of the pole sites. Where possible and practical, the trail would be located beneath the transmission line and within the ROW. In some areas terrain constraints, ground sensitivity or other considerations may preclude the access trail from travelling within the ROW, and the trail will be constructed as needed to maintain access.

The primary potential environmental impacts related to construction include the disturbance and removal of vegetation and soils associated with the clearing of the ROW, construction of the tote road, installation of the poles and stringing of the transmission cable. Outside of the tote road, vegetation removal will include tall growing tree species only, as grasses and shrubs are not a concern for overhead lines. Depending on location, construction activities will result in the temporary or permanent alteration or loss of terrestrial habitat. There is the potential for direct mortality of some wildlife species as a result of vegetation removal and trail construction, although this potential is relatively low given the low wildlife use of the pass.

Vegetation removal and soil disturbance has the potential to result in elevated erosion and transport of sediment into watercourses. This can result in negative impacts to aquatic habitat quality and productivity. Secondary potential impacts include wildlife disturbance due to construction noise and activity, which may result in temporary or longer-term avoidance of the area. Another potential impact is a small amount of wildlife mortality due to operation of vehicles or heavy equipment during construction. This may affect some small mammals and amphibians.

During construction there is the potential for workers, vehicles and equipment to act as vectors for seed dispersal. This could result in the introduction of non-native or nuisance plant species into the high elevation park ecosystems, which could negatively impact vegetation and wildlife habitat values. This potential impact is greatest where natural vegetation has been removed and soils are exposed.

Construction activities present various opportunities for potential negative impacts to environmental quality. These include vehicle and equipment re-fuelling, servicing and operation, dust, noise and exhaust emissions, and the generation and handling of hazardous and domestic wastes and garbage. The presence of workers and operating equipment always creates the potential for a wildfire to be initiated.

Using conventional, ground based methods a tote road or trail would be constructed for the equipment to gain access to each of the pole sites. Where possible and practical, the trail would be located beneath the transmission line and within the ROW. In some areas terrain constraints, ground sensitivity or other considerations may preclude the access trail from travelling within the ROW, and the trail would be constructed as needed to maintain access.

The trail would have to cross some streams and the alignment would include areas within the Steve Creek wetland. These areas are relatively sensitive to disturbance and there is the potential to generate sediment and impact water quality and habitat conditions at the stream crossings. The Steve Creek wetland is generally confined between steep, unstable slopes (Map 16). To construct and maintain an access road or trail through this area would likely require some filling within the wetland.

4.6.3 Buried Transmission Line

This construction method assumes an underground cable will be placed in duct for mechanical protection, ease of installation and emergency replacement. The cut requires excavation of bedrock and soils (depending upon local conditions) in which the underground cable is placed. The excavated material would be side cast for ease of replacement once the cable has been laid (cover). Typical excavation depths of up to 1.5 m would be required. Drainage material such as sand would have to be imported as a base for the duct.

The underground transmission line option requires a ‘span’ which is determined by the cable thickness and the maximum drum size that can meet the width and height requirements for highway transportation. For a 500 mm^2 cable the span length is 625 metres, and splice points are required every 620 m once cable pulling and cutting allowances are considered. Road access would be required to deliver the cable drums to the splice points for pulling through the duct as well as the pulling equipment. As a typical reel mass would exceed 10 tonnes it would be prohibitive to utilize a helicopter to lay such cable.

At each splice point an underground vault is required to house the splices. A typical splice for 230 kV, 500 mm^2 XLPE cable is 1.5 m long. A 15 m ROW is expected for the underground line to permit excavation for duct, side-casting the excavated material and working access. Due to the alpine environment, underground line construction may require rock blasting to create a trench to house the duct.

In general, the potential impacts related to construction include all of those discussed for the two other methods considered above, and these are not reiterated here.

The impacts to trees and forested ecosystems would be the least for buried cable, as the ROW width would be up to 30 m narrower than that required for overhead lines. Also, without overhead lines there would not be the need to maintain line clearance, nor would there be the ongoing vegetation management requirements. As such, compared with overhead lines, this construction method would significantly reduce the amount of trees that would need to be removed to accommodate the transmission line.

The ground disturbance for buried cable construction would be significantly greater than the overhead line options due to the nature of the 'cut and cover' approach of construction. It may not be feasible to bury the line through the Steve Creek wetland, and this could force the route up onto the slope at the side of the wetland. This is relatively unstable ground (Map 16), which would present other challenges for construction and long-term maintenance.

Buried cable construction would require the greatest amount of heavy equipment use, blasting, and soil disturbance. Vehicle access would be required to facilitate the use of equipment throughout the construction process as helicopter transportation for the materials and equipment required is not feasible. Bedding material for the transmission line duct would need to be trucked in to the park. Bringing in the ducting and bedding materials would require that the tote road be constructed to a higher standard, requiring more fill and ballast, which in turn would require hauling more material into the park. This method will take the longest to complete construction and would have the highest costs and highest risks related to wildfire, fuel handling and use, waste management and other major construction considerations.

Recommendation: Aerial construction of overhead lines is recommended as having the lowest potential for significant environmental impacts overall. This method will require the least ground disturbance and road or trail construction, has the lowest potential to result in erosion and sedimentation or to introduce invasive plants, and has the shortest construction time. It also has the lowest potential to create new access for motorised vehicles between the Pitt River and Mamquam watersheds.

4.7 Transmission Line Design Details

The engineering design report for the proposed transmission line crossing through the park is provided in Tab 5. The three-phase 230 kV line will be supported by 22 wooden pole structures, four of which will be two-pole structures and the remainder will be three-pole structures. The average span between structures will be 213 m. Twenty-four m high wooden poles will be used. Once the poles are set, they will stand approximately 21.3 m above ground. The length of the line crossing the park is 4.56 km, including slope distances.

4.8 Construction Impact Assessment and Mitigation Measures

Previous sections of this report describe the key impact mitigation measures that have been developed and included in the project design, including:

- Transmission line route location (based on environmental constraints)
- Proposed park addition (net increase in park area)
- Transmission line engineering (overhead lines on tall, wooden poles)
- Construction method (aerial installation)

This section considers the mitigative measures to be implemented during construction to minimize the potential for negative environmental impacts. Note that the methods of construction will be subject to review and approval by BC Parks and will need to be done under the authority of a Park Use Permit. Additional impact assessment and mitigation measures specific to key wildlife species are discussed in Section 4.10 of this report.

Although the transmission line ROW will be removed from the park and designated a Protected Area, it will continue to function as wildlife habitat within the same ecosystem context. As such, the overriding objective is to maintain the ecological integrity and function of the ROW as well as possible to support the wildlife populations and vegetation communities within the park and adjacent areas.

The most significant potential environmental impacts are related to the clearing of the ROW and the construction and maintenance of the transmission line. Vegetation removal will be done manually and will target only those trees that have the potential to interfere with the transmission line and those which are hazardous to worker safety. Vegetation clearing should avoid disturbance to compatible, low growing vegetation species such as shrubs and grasses. Tree removal is to be done in a manner consistent with the BC Parks *Tree Removal Policy for Parks and Protected Areas*.

Merchantable timber will be flown out of the park via helicopter to landings situated outside the park on either side and adjacent to forest roads. Options to manage logging waste from falling, bucking and limbing include piling and burning this material in the park or bundling it and flying it out of the park to burn or chip it, as determined in consultation with BC Parks. The timber volumes, harvest plan and related reports are provided in Tab 9.

Construction impact measures will need to address the potential for soil disturbance and erosion control. Minimizing soil disturbance can be achieved by incorporating several measures:

- Avoid moist soil conditions and otherwise consider ground conditions
- Utilize helicopters to deploy personnel, equipment and materials
- Minimize the amount of ROW clearing and vegetation disturbance
- Employ rig mats and other measures to protect the ground from equipment at the pole structure sites
- Limit vehicles, machinery and disturbance to the minimum areas required for construction
- Undertake effective site rehabilitation after construction and follow-up with post-construction effectiveness monitoring.

No in-stream works are proposed for the transmission line construction. Effective sediment and erosion control measures will be necessary to ensure that water quality is protected in the headwaters of Steve and Crawford creeks. No fish are present in upper Steve Creek, and the closest fish bearing waters in this stream are several kilometres downstream near the floodplain of the Pitt River. Conversely, upper Crawford Creek (Class S3) contains resident Dolly Varden char and these fish are expected to be present within the park.

There are eight stream crossings in the park: one crossing of Crawford Creek and seven crossings of tributaries to Steve Creek. The only pole structure that is situated within 20 m of a stream is Structure #2 near Crawford Creek (Lex Engineering 2007; Tab 5). This is also the only location where the proposed transmission line crosses a fish bearing stream in the park. In addition to sediment and erosion control, construction at Structure #2 will need to ensure adequate protection of riparian vegetation. For all stream crossings impact mitigation measures will include ensuring that vegetation clearing does not result in disturbance of stream channels or banks.

To minimize the potential for direct impacts to wildlife, the timing of vegetation clearing along the ROW would avoid the typical bird breeding period of April 1st to August 15th. Much of this period may have deep snow in the pass which would limit wildlife presence and preclude vegetation clearing. Prior to construction a biologist would conduct a survey of the areas to be cleared of vegetation to identify nests, dens and other sensitive features or wildlife activity. Sensitive times include late spring to mid- summer when grizzly bears may be foraging in the alpine and when mountain goats are kidding and young may be present. The most suitable time to avoid wildlife disturbance and also when there is little snow accumulation is in late summer and early fall; ideally in September and October.

The potential to introduce nuisance or invasive plants via seed dispersal would be minimized by contractor training and awareness, and cleaning and pressure washing equipment prior to use within the higher elevation terrain areas. Mitigation measures include minimizing exposed soils, retaining healthy, natural vegetation communities. Post-construction re-vegetation and a long-term environmental monitoring program would be required, and a noxious weed control program would be in place if required based on monitoring results. In the vicinity of stream crossings the revegetation plan should include planting naturally occurring species that are compatible with overhead transmission lines (e.g., grass, herb and shrub species).

A construction environmental management plan (CEMP) would be prepared to guide construction activities and minimize potential environmental impacts. Review of the CEMP would be part of the mandatory contractor training and awareness requirements. The CEMP is a standard requirement that describes routine and site-specific procedures for fire prevention and response, sediment and erosion control, wildlife interactions, fuel and chemical handling, emergency spill response, waste handling and measures to protect environmentally sensitive features. A qualified environmental monitor would oversee the implementation of the CEMP, liaise with government agencies and provide guidance for adaptive management to achieve environmental protection measures. The CEMP would need to be acceptable to BC Parks and all construction activities and impact mitigation measures would be subject to a Park Use Permit.

Restoration measures will consist of revegetation of areas disturbed during construction, including the establishment of compatible endemic plant species beneath the transmission line.

4.9 Operations Impact Assessment and Mitigation Measures

If the proposed park boundary adjustment is approved, the transmission line corridor will become a Protected Area. The Protected Area will be managed in a manner consistent with the surrounding parkland, and all operations and maintenance activities will be subject to the terms and conditions of a Park Use Permit.

Once constructed, a transmission line is generally a passive and environmentally benign linear development and for the vast majority of the time there will be no activity, disturbance, waste or noise associated with operations. Potential environmental impacts of power lines include electrocution of large birds, bird mortality from collision with structures and lines, and the leaching of wood preservatives from treated poles. These aspects are discussed below.

Unlike smaller, power distribution lines which are involved in the majority of raptor electrocutions, transmission line conductors and other apparatus are spaced far enough apart that even large birds are unable to touch two electrical contacts at the same time. Birds can readily fly onto and off of the support member without touching two electrical contact points. Hence electrocutions are rare incidents and typically only occur when large birds perch above conductors and excrete a large amount of fluid waste and a flashover occurs (Bradley 2003). The raptors' acute vision greatly limits the risk of in-flight collisions with the large diameter transmission conductors. As the risk to raptors is considered low, utilities are often encouraged to install artificial nesting platforms on transmission lines as a measure to enhance local raptor populations (Bradley 2003).

For the proposed park crossing there is very low risk of bird electrocution. The design of the transmission line specifies phase to phase separation between the conductors of 5.45 m for a tangent structure and up to 7.3 m for an angle structure. Insulators will be 1.9 to 2.0 m long and are to be hung vertically (Lex Engineering 2007; Tab 5).

In a detailed review of transmission line impacts on bird species, Bradley (2003) stated that most researchers agree that for healthy bird populations, collisions are not a biologically significant source of mortality, and have been estimated in numerous studies to usually run less than 1% of the local population. Bradley (2003) grouped the factors that influence the risk of collision into three general areas: engineering, animal related and local conditions. The risk of collision can be altered by changing a number of the engineering design characteristics. For power lines, by far the most important engineering factor is the overhead ground (static or earth) wire. Designs which make this wire more visible or remove it totally should reduce risk.

Other arrangements which decrease the risk are: a route that avoids bisecting daily movement paths; a line orientation which is parallel rather than perpendicular to flight paths along waterways or through confined valleys; increasing conductor visibility by using thicker conductors. These risks are minimized in the design of the proposed transmission line through Pinecone Burke Park, as there is no overhead ground wire and the line orientation is generally parallel to the flight path through the pass.

In general, the greater the bird population in an area, the greater the risk, which is tempered by the number of daily crossings of the line, the species size and manoeuvrability, flocking behaviour (increased risk with denser groupings), the height at which a species flies, the abundance of species that fly at night, and the presence of disturbances that startle the birds into flight (Bradley 2003). Risks are affected by the relative placement of the line to feeding and nesting and resting areas; if the line bisects these habitats, encounters and risk increase. Adverse weather conditions (more frequent fog, rain or snow, and higher wind speed) and the presence of distracting lighting will tend to increase interactions (Bradley 2003). The literature review indicates that the greatest risk is to waterfowl species and large migrations near water bodies. Given the very low bird population presence in the pass, especially during breeding season, the risks of bird collisions with the proposed transmission line through Pinecone Burke Park are considered very low.

As is standard practice for BC Hydro, the wooden transmission poles would be treated using chromate copper arsenic (CCA: Lex Engineering 2007; Tab 5) or another preservative to protect wood from rotting due to insects and microbial agents. CCA has been used to pressure treat lumber since the 1940s, and since the 1970s, the majority of the wood used in outdoor residential settings has been CCA-treated wood. Due to concerns regarding human health, in the last decade the US EPA worked with pesticide manufacturers to voluntarily phase out CCA use for wood products around the home and in children's play areas.

Concerns regarding the use of CCA arise from its toxicological properties, particularly to aquatic life. The closest a treated pole structure is planned to be placed to a stream is ~ 15 m (Structure 2; Tab 5), and it is considered unlikely that CCA leached from the poles would migrate this distance. For example, Morrell et al (2003) reported that levels of copper, zinc, and arsenic were elevated in soils immediately adjacent to ammoniacal copper zinc arsenate treated transmission line poles; however, the affected zone was generally confined to within about 1 m of the structure, and levels declined rapidly within 0.3 m of the pole and in the deeper soil zones sampled. As a result, the potential for environmental impacts due to leaching of wood pole preservative is considered low.

The potential for CCA leaching from poles can be reduced by ensuring that the CCA has properly fixed before the treated poles are shipped. Other measures to mitigate or avoid this risk include using arsenic-free wood pressure treatment alternatives to CCA, or by using alternative pole materials, such as steel. In the case of wood, the utility industry expects approximately 50 years of service: steel, concrete and fiberglass alternatives yield a lifespan of 80 to 100 years. Deciding whether the environmental, performance and duration benefits of steel pole structures outweigh visual quality and aesthetic values of wooden poles is another example of the trade-offs considered in project design.

The potential for environmental impacts during transmission line operation and maintenance are related primarily to line clearance and security. The key areas of activity to consider are emergency repairs and long-term vegetation management.

Emergency repairs will entail mobilizing people and equipment to rapidly locate and repair line failure issues. These issues are most likely to arise as a result of trees or branches contacting the line, but may include other incidents or events, such as avalanche, landslide, rock fall, ice or storms. Such issues can arise at any time of the year, but are most likely during winter, and will require prompt action.

If the line is interrupted an aerial inspection will be used to locate the problem. Access for work along the transmission line will be via helicopter. Open areas to land a helicopter for line service have been identified along the transmission line route (Lex Engineering 2007; Tab 5). Depending on the time of year, this activity could result in temporary wildlife disturbance.

There will be a vegetation management program in place to minimize the potential for trees to come in contact with the line. This will entail periodic vegetation control measures, such as tree falling, limbing, topping and girdling as necessary to maintain trees at a suitable clearance from the transmission line. Routine vegetation control is likely to take place every two to four years, and ‘spot treatments’ may be required in the interim based on inspection results. It is planned that only mechanical means of vegetation control will be used to avoid the potential hazards of chemical herbicide use. Impacts will be primarily the direct removal of trees. Secondary potential impacts will include fuel handling and noise disturbance if chain saws are used, and wildlife disturbance which may cause stress and / or avoidance of the work area. Wildlife conflicts are always possible when operating in remote areas.

A vegetation management program will be developed and included in the Operational Environmental Management Plan (OEMP). Vegetation management will be done manually using non-chemical means.

The OEMP will provide guidance and routine measures to minimize ongoing potential environmental impacts related to operations. The OEMP would need to be acceptable to BC Parks as all maintenance and operations activities would be subject to a Park Use Permit.

4.10 Potential Impacts to Key Wildlife Species

Wildlife use of the study area is expected to be greatest during the construction phase of the proposed northern route of the transmission line through Pinecone Burke Provincial Park. The key ecological impacts on wildlife associated with the development are the removal of old growth forest cover and the disruption of wildlife, mainly during the construction phase. The conversion of forest habitats to shrub layers along the alignment will benefit some species while reducing suitable habitat for others. Potential sources of impacts on priority wildlife species during the construction and operation phases of the proposed development are discussed below.

4.10.1 Coastal Tailed Frog

In BC, the Coastal Tailed Frog (*Ascaphus truei*) is on the provincial *Blue List* in BC and is designated as a species of *Special Concern* in Canada (COSEWIC 2002). Coastal tailed frogs were observed in many streams throughout the upper Pitt River watershed, including a tributary of Steve Creek immediately east of the park boundary. Although the Crawford-Steve Pass may be at or near the altitudinal limit of the species, there are several streams with suitable habitat that are along the proposed transmission ROW and the species is assumed to be present.

The removal of vegetation adjacent to these streams within the ROW may affect tailed frogs during construction, although the use of hand-falling and heli-logging rather than ground-machinery will minimize this risk. There is also some potential for a short-term increase in sediment input into the streams, resulting from any disturbance to stream banks during logging. Increased sediment levels associated with logging (Bull and Carter 1996) or natural disturbance (Hawkins *et al.* 1988) has been associated with reductions in larval tailed frog densities and biomass. Again, the use of hand-falling and heli-logging techniques which will minimize disturbance to understory vegetation adjacent to streams should minimize this risk to the species. In addition, the relatively steep gradient of these streams should mean any fine sediment will be washed out of the channel relatively quickly (Murphy and Hall 1981) and the rapid growth of retained understory vegetation expected after canopy removal should quickly stabilize any disturbed stream banks.

4.10.2 Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) are likely to be found anywhere long the coast of BC within 30 km of the Pacific coast, with some birds venturing up to 80 km inland (MWALP 2004a). It is a red-listed species in BC and is designated as *Threatened* in Canada (COSEWIC 2002). No potential nesting habitat for the murrelet has been identified in the study area (MWALP 2004b), none was observed during field studies, nor were any murrelets detected.

The marbled murrelet is a somewhat migratory bird (MWALP 2004), and it is possible that it uses the Crawford-Steve Pass to move between watersheds. As such, there is some potential for impacts on the species during the operation phase of the project due to the risk of electrocution and/or bird-strike of the transmission lines as birds fly through the study area. Given that the route of the transmission line is parallel to the flight corridor and predominantly located on the southern edge of it the impact of collision on all bird species, including the murrelet, is expected to be low, as discussed in Section 4.9.

4.10.3 Northern Spotted Owl

The Northern spotted owl (*Strix occidentalis caurina*) is Red-listed in BC and is considered *Endangered* in Canada (COSEWIC 2002). The species inhabits mature and old growth, low elevation forests where they feed on small mammals, especially flying squirrels (MWALP 2004a). Large, contiguous stands of old forest (> 140 years) are the most valuable habitat, as small remnant patches are unlikely to be used for nesting, especially if surrounded by very young forest or non-forest vegetation. Stand-level characteristics important to spotted owls include multiple canopy layers, high levels of coarse woody debris, and many snags and large live trees with deformities. No suitable or capable nesting or foraging habitat of the spotted owl has been identified in the study area (MFR 2007) nor were any owls detected in call-playback surveys conducted during this study. Hence, no impact on spotted owl nesting or foraging habitat is anticipated from the proposed development.

Juvenile spotted owls are obligate dispersers (MWALP 2004a) and an active nest site was identified approximately 10 km to the north-east of the study area in Garibaldi Provincial Park (Sutherland *et al.* 2007), within the dispersal capabilities of the species. There is potential that dispersing juveniles may use the Crawford-Steve Pass to move between watersheds, with associated low potential for impacts as per the marbled murrelet discussed above.

4.10.4 Black-tailed Deer

The key limiting habitat for Columbian black-tailed deer (*Odocoileus hemionus columbianus*) is generally considered to be winter range (Armleder *et al.* 1994). No deer winter range occurs in the study area due to the depth of the snow-pack in winter (4 to 5 m). Deer prefer areas where snow depths are less than 30 cm, and are excluded from areas where snow depths are greater than 50 cm (Telfer and Kelsall 1979; Simpson and Gyug 1991).

Field surveys of the study area indicated there was ample forage and security habitat available to the black-tailed deer throughout the growing season, and deer-sign was abundant, including a game trail through the Crawford-Steve Pass. It is anticipated that the removal of forest cover within the proposed transmission ROW will have a low impact on the species due to a small loss of security habitat, but the species will benefit from the development of additional forage habitat in the form of a well-developed shrub and herb layer through the formerly forested areas. The temporary reduction in security cover could result in increased potential for predation by cougar, and this effect will be reduced with the establishment of a shrub layer along the transmission ROW.

It is likely that most black-tailed deer will avoid the construction area during working hours due to construction-related noises, limiting foraging and movement activities mostly to the period between dusk and dawn. Some individuals may leave the area altogether during the construction phase of the development. However, given that most deer are still likely to access the construction area during non-work periods and that abundant forage and security habitat is available to the species at other periods throughout the study area, the impact of construction activities on the species is expected to be low.

4.10.5 Mountain Goat

Mountain goats (*Oreamnos americanus*) are considered to be a *Regionally Important* species in BC because they require older age class forests for winter cover. Similar to the black-tailed deer, the key habitat considered to be limiting for the mountain goat is winter range. High-value goat winter range within the Fraser Timber Supply Area, encompassing the study area, is characterized by the combination of escape terrain, southerly aspects, and mature-old forest structure, generally within 400 m of escape terrain (Jex 2002). Goat Winter Range (GWR) has been identified immediately east of the study area (GWR #P14) and is known to be used by the population in the area. However, there is no identified GWR within the study area, and the proposed alignment of the transmission ROW along slopes with a northerly aspect, should avoid any impacts on potential GWR within the study area.

Mountain goats are expected to use higher elevation summer range areas within the study area during the construction period. This is a critical period for goats as kidding occurs at the beginning of summer, generally on protected ledges in steep, rocky escape terrain with food and water nearby (Arthur 2003). Goats are considered to be sensitive to human disturbances, such as blasting and helicopter activity. These activities will occur regularly during the construction phase of the development, but will be of short duration, if construction can be completed in one season.

Studies examining the causal relationships and the severity of disturbance effects on goats are limited. Potential mountain goat responses run the full spectrum from an increase in energetic costs (via increased vigilant behavior and short-term movement away from areas of high forage quality: Gordon 2005; Matheson 2005) to population effects (if frequent disturbance results in the long-term abandonment of quality habitat and increased risk of predation and injury), although the latter response is speculative. With respect to helicopter activity minimum flight distances from known goat populations are set at precautionary best estimates of 1.5 to 2.0 km. Nine mountain goats observed at low elevation during a helicopter overflight on the south side of Bucklin Creek on October 30, 2007 did not appear to be disturbed by the helicopter's presence, and continued to forage at a distance of approximately 500 m. It is likely that mountain goats within the Pitt River watershed are somewhat accustomed to helicopter disturbance due to the frequent presence of helicopter activity, relating to forestry and eco-tourism. For example, heli-fishing occurs frequently in the Pitt River watershed, with flights based out of Squamish using the Crawford-Steve Pass.

The availability of suitable high elevation summer range outside the study area is a key factor in mitigating the potential impacts of the development on mountain goats. Immediately to the north of the study area, in the Bucklin Creek drainage, suitable summer range is available that appears to be more widely used by goats. Goats will undoubtedly exhibit avoidance behavior of the study area during the construction phase of the development, with likely energetic costs for individuals, but with the availability of alternative summer range nearby, impacts should not manifest themselves at the population-level.

In the absence of a better understanding of the effects of human disturbances on mountain goats, one recommended approach is to apply the principles of adaptive management, with site specific mitigation plans used along with an onsite monitor to ensure implementation and compliance (Matheson 2005). In addition, interim guidelines to ensure mountain goats are not impacted by helicopters are available (MoE 2006). Care must be taken to reduce the possibility of surprise encounters with goats or unplanned flights into disturbance space. To achieve this, the following measures should be applied to flight planning and helicopter operation.

- Concentrate flight lines in the centre of valleys
- Keep helicopters below goats
- Avoid flying through passes and over ridges near occupied goat range
- Pilots should inform each other of goat sightings and activity and plan flights to avoid goats
- Avoid flying directly towards goats
- Do not hover or land near goats
- Minimize time spent in disturbance space
- Minimize the number of flights into disturbance space
- Keep helicopters as far from goats as practically possible.

4.10.6 Black Bear

Black bears (*Ursus americanus*) inhabit all forested regions of BC, can be found in all biogeoclimatic zones and occupy a wide variety of habitats ranging from coastal estuaries to alpine meadows (MELP 2001). Ample forage and security habitat is available to black bears throughout the study area, and lots of evidence of seasonal use by black bears was observed during field surveys. It is possible that black bears may den in the vicinity of the proposed transmission line, as tracks were observed by Lex Engineering in May 2007 and by Streamline Environmental Consulting Ltd. in October 2007 in the Crawford-Steve Pass

Short-term impacts of the proposed transmission line ROW include the potential for avoidance of the study area by the species during the construction phase, and the disruption of movement during working hours. Black bears will typically avoid the presence of humans, unless attracted by atypical food sources (MELP 2001), and the presence of machinery, helicopters and associated noise during the construction period is expected to result in temporary avoidance of the study area by bears.

Due to the wide availability of alternative forage and security habitat within the species' large home ranges this is likely to result in negligible impact. In the longer-term, the conversion of forest cover along the transmission ROW to a well-developed shrub and herb layer is likely to benefit bears through the provision of additional growing season forage, with minimal loss of security cover. The project is not expected to result in alienation of habitat.

The potential for human-bear conflict can be reduced through proper disposal and storage of garbage, oils and lubricants which may attract bears to the construction area. A Bear Management Plan will be developed and Bear Awareness training for construction personnel should be put in place.

4.10.7 Grizzly Bear

Grizzly bear (*Ursus arctos*) historically occurred throughout most of BC, but populations are considered extirpated from much of south and south-central BC (MWALP 2004a). The species is Blue-listed in BC and is considered of *Special Concern* in BC by COSEWIC (2002). The study area falls within the Garibaldi-Pitt Grizzly Bear Population Unit (GBPU) which is considered *Threatened* by COSEWIC (2002). The estimated population size of this GBPU is 18 bears, amounting to only 8 % of the habitat capability of this area (Hamilton *et al.* 2004). Given such a low population density, it was not surprising that no grizzly bear sign was observed during field surveys. Ongoing grizzly research by the Ministry of Environment, which included a hair snag site near Steve Creek, has also failed to produce evidence of grizzly use of the area (G. George, MoE, pers. comm.). Nevertheless, ample growing season forage and security habitat occurs throughout the study area and a draft Grizzly Bear Wildlife Habitat Area has been identified in the upper Steve Creek drainage, east of the Park boundary, so it is assumed that grizzlies do occasionally use the study area.

Potential impacts and impact mitigation measures of the proposed transmission ROW on grizzly bears are anticipated to be the same as for black bears, with the exception that if human-bear conflict leads to mortality of a grizzly bear, particularly an adult female, this would likely have a moderate impact on the local population due to its low density. The project is not expected to result in alienation of grizzly bear habitat.

4.10.8 Wolverine

Wolverine (*Gulo gulo*) are widely distributed at low densities throughout most of BC and can be found from valley bottoms to alpine meadows (MWALP 2004a). The mainland subspecies of wolverine is Blue-listed in BC and the western Canadian population of wolverines is considered to be of *Special Concern* by COSEWIC (2002).

No evidence of wolverine presence in the study area was obtained during field surveys, and trappers who operate in the area indicated that they have not observed wolverines. However, there are anecdotal reports of wolverine sightings in the Pitt River watershed. Potential habitat, including multiple prey sources, for wolverines occurs throughout the study area. Therefore, it is possible wolverines use the study area on occasion and may be impacted by the proposed development. Wolverines are sensitive to human disturbance. Krebs *et al.* (2007) found that heli-skiing and backcountry skiing were negatively associated with winter habitat use by female wolverines. In summer, females were positively associated with roadless areas and negatively with recently logged areas. As such, wolverines are expected to avoid the study area during the construction phase of the development. However, given the landscape-scale at which wolverines operate and the relatively small footprint of the proposed transmission ROW, the impact is expected to be very low and no other potential impacts on the species from the development are anticipated

4.11 Proposed Park Addition

As part of the overall impact mitigation strategy related to the park boundary adjustment, NWCP proposes to add 492 ha of Crown land to Pinecone Burke Provincial Park. This area is located on the east boundary of the park in the Steve Creek watershed, and is shown in Map 6. The vegetation resources inventory of the park addition area is shown in Map 9, and ecosystem mapping of this area is shown in Map 12 (Tab 4).

The proposed addition of new area to the park is proposed in order to enable the park boundary adjustment to result in a net gain in the park area. The net gain would be 471 ha, with the removal of 21 ha for the transmission line through the park. The area proposed to be added has identified wildlife habitat values and is not expected to result in a loss of timber supply in the Fraser TSA. Details regarding the park addition from a timber supply perspective are discussed in Tab 9. Timber supply attributes of the proposed park addition area are summarized in Table 3.

The proposed park addition area has been discussed with the Katzie First Nation and Teal-Jones Group. This area was reviewed in the field (via helicopter) and in consultation using maps and photographs of the area with Teal-Jones Group representatives. The boundaries were adjusted several times to reflect input provided by Teal-Jones Group in order to minimize potential impacts to future harvesting opportunities. However, the licensee indicated that they could not support the park area addition due to an unresolved claim with the Provincial Government arising from the original creation of Pinecone Burke Park.

The proposed park addition area includes draft Goat Winter Range and grizzly Wildlife Habitat Area identified by BC MoE (Table 4). The objectives for wildlife habitat protection would be well addressed if these areas become park, contributing to biodiversity at the landscape level. Goats have been observed along the north-east border of the draft GWR and they are likely using much of the area proposed as park addition, especially in the north east of the area. During April 2007, with the deep snow pack goats were using exposed rocky north-facing slopes in the Bucklin Creek area: snow accumulations measured > 4.5 m in the Crawford-Steve Pass and deep snow pack was present throughout the south-facing slopes in the Steve Creek drainage.

The proposed park addition area has been brought to the attention of the Fraser TSA Cooperative Association, who is in discussion with the provincial government regarding the assignment of wildlife and biodiversity areas in the Fraser TSA.

Table 3. Timber attributes of the proposed park addition.

Contributing Class*	Total Area (ha)
Contributing	<0.01
Partially Contributing	15
Non-Contributing	42
Excluded	415

*Source: P. Carruthers, R.P.F.

Table 4. Ecosystem attributes of the proposed park addition.

	Total Area (ha)	Area in Proposed Park Add^{n} (ha)	Area Outside Park (ha)	% in Proposed Park Addition
Proposed Park Addition	492			
Draft Goat Winter Range	485	337	148	69%
Draft Grizzly WHA	92	68	24	74%
Steve Creek Wetland*	25	19*	0	76%

* Remaining area in existing park

4.12 Impact Mitigation and Residual Effects

In general, the potential environmental impacts discussed throughout Section 4 should be adequately addressed through implementation of the impact mitigation measures proposed. This includes potential impacts to wildlife and ecosystems as a result of project construction and project operations. Environmental impact assessment is an uncertain process dealing with future conditions and potential impacts, and there is always the potential for residual effects to occur.

The key residual effects expected to occur include the removal of trees along the transmission corridor, and the potential for wildlife disturbance during construction and during transmission line maintenance. Secondary residual effects include the (low) potential for bird collisions with the transmission line and the localized effects of pole structure placement and wood preservative leaching.

In general, it is expected that herb and shrub species will become predominant in areas where trees are removed beneath the transmission line. The residual effect is a shift in ecosystem types, and in some cases this is expected to benefit wildlife species (e.g. forage), and in other cases it may negatively impact species (e.g. removal of cover).

The effects of wildlife disturbance can be very difficult to predict. In some cases this may lead to avoidance of the area, possibly including flight and stress responses that can affect the health and survival of individual animals.

4.13 Cumulative Effects

In general, the environmental impacts discussed throughout Section 4 have been addressed through the impact mitigation measures proposed. However, when considered in the context of surrounding land uses, the significance and extent of potential environmental impacts can increase, as is the case in the study area.

The predominant land use in surrounding areas is forestry. Both the Mamquam River and Pitt River watersheds have been logged extensively and continue to be harvested. This has the effect of vegetation removal, alteration of forest age class structure, habitat alteration and species disturbance on a much greater scale that that proposed for the transmission line. Forestry operations, including heli-logging and conventional logging result in a fair amount of noise and human activity throughout the area. Eco-tourism (which includes helicopter flights through the project area) and motorized recreation also contribute to wildlife disturbance.

The areas designated as park provide important refuge for wildlife species and protect habitats that support biodiversity. As such, protected areas play an elevated role in managing wildlife and biodiversity across a landscape or region.

The proposal to add 492 ha of new area to the park is important to addressing the potential cumulative effects of the proposed 21 ha transmission line corridor through the park. This additional area has been selected based on its habitat suitability for key wildlife species, including mountain goat and grizzly bear.

5.0 VISUAL QUALITY IMPACT ASSESSMENT

A visual quality assessment (VQA) of the proposed transmission line crossing of the park was conducted by Ken Fairhurst, R.P.F. of RDI Resource Design Inc. The VQA is provided in Tab 6, which also includes the previous VQA that was done for the comparison of the northern and southern transmission line route options.

6.0 TOURISM / RECREATION IMPACTS

Published or quantitative information regarding recreational use within Pinecone Burke Provincial Park are limited. However, BC Parks document entitled*: Management Plan: Background Report for Pinecone Burke Provincial Park* provides an overview of identified recreational values and key features within the park.

While more detailed planning is required for the park to the create a Master Plan (setting out land uses and permitted uses) this report assesses the proposed transmission corridor in relation to available information and secondary source information collected as part of this review.

The *Background Report* provides details regarding recreation features and activity areas within Pinecone Burke Provincial Park, although formal recreational facility development in the park is minimal.

The *Background Report* identifies five recreational areas:

- Burke Mountain
- Widgeon Valley
- Pitt Lake
- Debeck – Boise Wilderness
- Pinecone Lake Wilderness

The proposed transmission corridor through the Crawford-Steve Pass is within the general Pinecone Lake wilderness area. The recreational characteristics attributed to this area include day hiking, backpacking, camping, swimming, scenic viewing, mountaineering, rock climbing, nature study and wildlife viewing. Currently limited use occurs in this wilderness area. The main recreational features identified in this area are Pinecone Lake, Knothole Lake, November Lake and numerous small lakes in a sub-alpine setting. The proposed transmission line crossing area in the Crawford-Steve Pass is not identified as a feature in the Pinecone Lake recreational area.

The Pinecone Lake recreational area represents the most northern and inaccessible portion of the park and provides wilderness opportunities, especially surrounding Pinecone Lake and the Consolation lakes. The proposed transmission corridor is located one pass north of Pinecone Lake and the transmission line would not be visible to Pinecone Lake. This area has limited accessibility except via Pinecone Creek and the Mamquam Forest Road which limits the potential use of the area for wilderness recreation.

The upper Pitt River watershed, to the east of Pinecone Burke Provincial Park currently has limited recreational use as the area is limited to boat access. The upper Pitt River is used for commercial sport fishing and eco-tourism, including jet boat fishing and guiding along the river.

The Mamquam Watershed immediately to the west of Pinecone Burke Provincial Park is accessible by road and has higher recreational use; both motorized (ATV's and snowmobiles) and non-motorized (mountain biking, kayaking, hiking).

The *Background Report for Pinecone Burke Provincial Park* indicates that those areas within Pinecone Burke Provincial Park that exhibit the greatest potential for recreational activities are located in the southern portions the park (Mountain, Widgeon Slough and Pitt Lake areas), as these areas are accessible to the public. The northern sections of the park, identified as the Debeck-Boise and Pinecone Lake areas, are relatively inaccessible and more suited for wilderness and backcountry experiences.

According to the BC Parks web site the recreational features within these areas are focused on Burke Mountain, as illustrated by trail map of the park shown on the BC Parks web site.

6.1 Recreational Use of the Proposed Project Area

NWCP undertook a literature review of hiking forums, hiking journals and interviewed locals regarding hiking activity through the Crawford-Steve Pass. The results indicated that a limited number of hikers have attempted to hike the pass. Discussions with locals indicated a teacher from Victoria used to take his class hiking through the pass in an attempt to reach the hot springs. There are no indications that he still does this. Overall, the literature review of hiking forums and discussions with locals indicated that hiking through the pass was limited, although attempts have been made.

To record wildlife and recreation use of the area, four motion triggered still photograph cameras were installed in the Crawford-Steve Pass on July 25, 2007 (just as the last snow was receding from the pass) and were retrieved October 25th, 2007 (at the onset of snow in fall). Two cameras were located in the wetland area (eastern end of the pass) and two were installed along the narrowest section of the pass connecting the western park boundary to the pass (western end of the pass). Two of the cameras failed during this period, one due to malfunction and the other at the hands of a curious bear.

Two cameras remained functional throughout the summer. The wetland camera took 19 photos of wildlife and human activity which were captured on film; consisting of predominantly bear and deer, as well as one photo of BC Parks staff and NWCP representatives in the pass during a scheduled field visit. Based on data catalogued all pictures were taken before mid-August. The other camera focused on the game trail through the narrowest section of the pass (western portion of the pass) which captured images for the entire summer period July 25th to October 25th, 2007. Throughout that period only one hiker was photographed. The individual entered the pass from Crawford Creek and returned back via Crawford Creek the same day (July 26th). Biologists undertaking wildlife studies in the park on behalf of NWCP spoke to the individual regarding his hike. He indicated that he did not encounter other hikers on his trip and also noted that he had made an attempt to hike the pass the previous year.

6.2 Improving Recreation Opportunities in the Park

While existing access to the Pinecone wilderness area in the park is limited, the development of the transmission and the infrastructure necessary to construct the proposed hydropower projects at Crawford, Steve Creek and Pinecone creeks will increase access to this area, though this will remain outside the park.

BC Parks asked that this proposal identify opportunities to improve recreation within the park. The improved and new access resulting from the hydropower projects does present the opportunity to facilitate access for hikers into areas such as Pinecone Lake. For example, creating a hiking trail loop via the Steve Creek and Pinecone Creek valleys (which will be subject to improved access along these corridors as a result of project infrastructure) to access Pinecone Lake creates a unique opportunity for improved linkages to this wilderness area. The critical issue however in proposing such a plan will be the ability to limit unwanted access to the area from motorized vehicles. Another consideration is that of encouraging hikers to use a remote area frequented by bears, which may sometimes include grizzly bear. This could lead to conflict, including encounters that are lethal to either bears or people.

NWCP can assist with the development of recreational access if that is desired by BC Parks and Katzie First Nation. This could include, for example maintaining road access to the intake locations of the proposed hydropower projects at Crawford, Steve Creek and Pinecone creeks, and providing parking areas, bear-proof waste containers, and trail head signs and maps for hikers wishing to access the park.

Preliminary discussions with Katzie First Nation regarding ecotourism and cultural tourism initiatives within their traditional territory and potential opportunities in the upper Pitt River watershed have confirmed an interest in the development of such activities. Whether such an initiative would be supported by Katzie First Nations is currently under consideration as part of ongoing discussions with NWCP.

6.3 Effects on Road Access to the Park

Limiting access through the Crawford-Steve Pass was a desire expressed by Katzie First Nation and stakeholder groups, including the Alvin Community Residents Society (ACRS), Western Canada Wilderness Committee (WCWC) and the Burke Mountain Naturalists (BMN). These organizations expressed concerns that the construction of a transmission corridor may create unwanted access for motorized vehicles. Increased road access can result in increased recreation and hunting pressure.

Note that no new roads into the park or to the park boundary are proposed.

On the east side of the park in the upper Pitt River watershed, which is accessible only by boat through Pitt Lake, the nearest road to the park will be the new road proposed to be constructed to the intake location at Steve Creek, approximately 1.5 km from the park boundary. However, potential impacts to access and recreation are expected to be low as access to this area requires access to the upper Pitt River via boat, then traveling another 23 km of forest roads to lower Steve Creek.

The nearest access point on the west side of the park will continue to be the forest road at Crawford Creek. The hiker who was encountered in the park in 2007 stated it was difficult to access upper Crawford Creek using a four wheel drive vehicle due to road conditions, including deactivated stream crossings. Road improvements associated with construction of the proposed hydropower project at Crawford Creek and for transmission line construction will reestablish culverts at stream crossings and improve access to upper Crawford Creek. Aerial construction of the proposed overhead transmission line is not expected to create new or better access to the park than currently exists at Crawford Creek.

Potential impacts related to hunting pressure are expected to be low. There are many more accessible areas on either side of the park available for hunting and Pinecone Burke Provincial Park is open to hunting only from September 10 to June 15 during a lawful game season. During most of this period the Crawford-Steve Pass is typically snow-covered.

Aspects of potential recreational access will be reviewed with BC Parks and Katzie First Nation. If desired by these parties, it is possible to use large woody debris placed by helicopter in combination with terrain conditions to create barriers to unauthorized motorized vehicles.

6.4 SOCIO-ECONOMIC IMPACT ASSESSMENT

The British Columbia Input Output Model (BCIOM) was utilized in determination of provincial economic benefits associated with the project. Project benefits included 1950 person years of employment, \$14.8 million in provincial taxes and \$12 million in federal taxes (see Section 3 and Appendix A).

NWCP has held discussions and a job fair with Katzie First Nation regarding the development of an employment strategy intended to optimize opportunities for First Nations to obtain construction and operations employment. NWCP has also discussed the development of a local procurement strategy with the Fraser

Valley Regional District (FVRD) to optimize local contracting appointments associated with the project.

As the proposed project is in an uninhabited area of the FVRD, the social impacts of the project will be negligible. In the Pitt River watershed, potential social impacts will apply to a small number of cabin owners and residents, and local outfitters such as Pitt River Lodge that operate in the valley. Key issues (impacts) the residents have identified include the visual impacts of the transmission line and the potential to impact resident's day to day enjoyment of the valley during construction and during operation. There was also significant concern regarding the potential development of the valley, and the influx of tourists and potential recreational property owners, as well as the issue of unwanted access to the valley by motorized recreational vehicles. These issues are primarily related to the project as a whole and the developments within the Pitt River watershed, and are being addressed in the BCEAA Environmental Certificate process.

As discussed in Section 6.2, the project does provide an opportunity to enhance recreation and park use, if this is desired by BC Parks. There is little change expected to public access and vehicle traffic as a result of the project, as discussed in Section 6.3, above. A social benefit will result from the addition of area to the park if this proposal is accepted (see Section 4.11). The proposed park addition will benefit wildlife and biodiversity and may contribute to public use of parkland, while at the same time it will not reduce economic opportunities and benefits related to forestry.

As discussed in Section 7.0, public consultation identified opposition to the proposed park crossing. The opposition to the park crossing was based on the principle of placing a utility corridor in a Provincial park, and not on technical aspects of the proposal itself. NWCP commissioned Typlan to conduct a benchmark review of commercial and industrial operations within parks in North America, including utility corridors. This review is presented in Tab 10.

One of the key social issues identified through community consultation was the potential visual impacts of the proposed transmission corridor and infrastructure at the creeks. As part of this review, NWCP commissioned a visual quality assessment VQA) of the two transmission routes that we re considered, and a detailed VQA of the proposed final; transmission line through the park. The VQA reports are provided in Tab 6.

7.0 LOCAL COMMUNITY CONSULTATION

Local community consultation with the general public, municipal officials, stakeholders and non government organizations, local chambers of commerce and rotary clubs has been extensive. Activities include:

1. Stakeholder Engagement and Correspondence
2. Public Information Sessions
3. Workshops with Non-Government Organizations (NGO's)

NWCP has identified over 170 specific activities related to either providing or responding to information requests regarding the project to municipal staff, First Nations, Rotary Clubs, Chamber of Commerce, stakeholders and NGO's. Refer to the *Local Consultation Report* for details (Typlan 2007: Tab 7).

Public information sessions were completed in Squamish and Pitt Meadows to provide the general public information regarding the project and review processes, including the proposed park crossing and boundary adjustment. Based on comments provided by those attending the information sessions and written submissions, the need to undertake specific presentations and workshops with interest groups and NGO's was verified.

Subsequently NWCP organized a series of presentation/workshops which provided additional project details. The information was presented by the technical consultants retained by NWCP. Presentations and workshops (half day presentation and workshop) included the following:

1. Alvin Residents Community Society (ARCS)
2. Burke Mountain Naturalists (BMN) and the Western Canada Wilderness Committee (WCWC)
3. Alouette River Management Society (ARMS)- which included representatives from :
   - Alouette Field Naturalists (AFN)
   - Burke Mountain Naturalists (BMN)
   - Pitt River Watershed Network (PRAWN)
   - Hyde Creek Watershed Society (HCWS)
   - upper Pitt Property Owners (3)
   - MLA Michael Sather (Maple Ridge/Pitt Meadows) & Assistant
   - BC Parks
   - BC Conservation Society
   - DFO
   - Maple Ridge News

All meetings followed a standard format which included a detailed PowerPoint presentation outlining:

- Project location
- Transmission line requirements
- Hydrology
- Location of intake weirs, penstocks, powerhouses locations
- Anadromous barriers and fish habitat by type of species
- Park boundary adjustment requirements

The presentation was followed by an interactive workshop with questions and answers. The results clearly illustrated an interest of participants to obtain additional information regarding the project (technical documents being prepared for the EAO) and an identified opposition to the proposed park crossing. The opposition to the park crossing was based on the principle of placing a utility corridor in a Provincial park, and not on technical aspects of the proposal itself.

8.0 FIRST NATIONS CONSULTATION

First Nations consultation has been extensive and is summarized in Tab 7. Activities include initiatives of the Environmental Assessment Office (EAO) as well as NWCP. Activities consist of four specific themes:

- Environmental Assessment Office: Letters to First Nations
- NWCP letters to First Nations
- Katzie First Nation Consultation
- Katzie First Nation Relationship Building
- Squamish First Nation Consultation

The EAO circulated registered letters to approximately thirty-two (32) First Nations potentially affected by this project. To date the NWCP office has received little response for requests for additional information or consultation from the above. One letter response from the Kwikwetlem First Nation (Coquitlam First Nation) was received by the NWCP office, subsequently, NWCP met with the Coquitlam First Nation and provided a presentation and forwarded project materials to the band office. NWCP has also forwarded registered letters and a copy of the initial newsletter to seven local bands.

Parent company Run of River Power Inc. has negotiated a participation agreement with Squamish First Nation associated with the operation of Brandywine Creek Hydroelectric facility. NWCP has also undertaken a number of meetings with Squamish First Nation representatives related to the proposed transmission corridor, however on Oct 2, 2007 the Squamish First Nation forwarded a letter to NWCP indicating that their opposition to the development of the right of way and that the proponent and the Province find another route for the project.

A review of the Sea to Sky Land Resource Management Plan or LRMP (Land Use Designations – Compiled First Nations Agreement Areas) identifies that the land use designation in the Mamquam valley (the area of the proposed transmission corridor) is Integrated Forest Management Zone. This designation is defined by the plan as areas in which forestry, mining and independent power production, recreation and other activities are allowed under existing regulatory framework of legislation or policy. The lower portion of the Mamquam is designated by the LRMP as Front Country. This area equates to the view shed from the paved highways through the Sea-to-Sky corridor, with "visual quality objectives" providing interim direction (mainly for forestry development) until a visual landscape management strategy is developed. It was recommended that all development industries conform to these objectives.

A number land use issues remain outstanding with Squamish First Nation and the Province. NWCP is aware of such discussions between the entities and is continuing to consult with Squamish First Nation to identify their concerns and work towards addressing them as best possible.

Over the last year NWCP has met with Katzie First Nation approximately twenty times to develop a relationship between the parties. Those discussions have culminated in a letter from Katzie First Nation (dated December 3 2007) stating Katzie First Nations' intent to negotiate a formal agreement with NWCP.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The assessment of impacts has identified the key potential environmental impacts of the proposed transmission line corridor. Appropriate impact mitigation measures have been identified to address potential impacts arising from the proposed project.

Potential residual effects of the proposed project are considered insignificant. Potential cumulative impacts will be addressed by including the proposed 492 ha park area addition.

This report and the supporting documents (as separate tabs in the overall Application binder) satisfy the requirements of the Provincial Park Boundary Adjustment Policy, Process and Guidelines. This includes demonstrating that the project is in the public interest and has been designed to minimize potential adverse effects and to provide benefits to the Province, the public and to Pinecone Burke Park.

9.2 Recommendations

It is recommended that the boundary of Pinecone Burke Park be adjusted as proposed by NWCP, including the addition of the 492 ha parcel on the east side of the park. This recommendation is subject to all of the impact mitigation measures outlined in this report being required as a condition of the boundary adjustment, including the preparation of detailed construction and operations environmental management plans and environmental monitoring as necessary to ensure the goals of such plans are achieved.

It is recommended that NWCP and BC Parks meet to review and finalize the commitments of NWCP to provide benefits to the park and park uses, including facilities, monitoring and research to support park management.

The proposed area to be removed from the park is 70 ha, which has deliberately been made larger than the 21 ha required for construction to ensure that any necessary adjustments to the location of structures during construction remains within the legally defined area. At the conclusion of transmission line construction it is recommended that the line be surveyed, and the 49 ha area that was removed from the park which is not occupied by transmission line be retuned to the park, resulting in a net gain of 471 ha to the park.

10.0 DISCLAIMER / STATEMENT OF LIMITATIONS

This report was prepared exclusively for Northwest Cascade Power Ltd. by Barkley Project Group Ltd. and Typlan Consulting Ltd. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on: i) information available at the time of preparation; ii) data collected by Barkley Project Group Ltd., Typlan Consulting Ltd. and/or supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Northwest Cascade Power Ltd. only. Any other use or reliance on this report by any third party is at that party's sole risk.

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