Watershed Watch Salmon Society
Watching Out for BC's Wild Salmon

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DOCKET
11-RPS-01
DATE MAR 02 2012
RECD. MAR 06 2012

March 2, 2012

California Energy Commission
Sacramento, CA
Sent via email

Re: Docket number 11-RPS-01

Dear California Energy Commission:

Watershed Watch Salmon Society is a federally-registered charity in British Columbia. Our mission is to catalyze efforts to protect and restore BC's precious wild salmon and their habitats.

We understand that the California Energy Commission (CEC) is charged with determining whether BC hydropower facilities "*are*, or should be considered eligible renewable electrical generation facilities for California's RPS." We have provided previous submissions to your agency and other California state agencies providing evidence that the vast majority of BC's hydroelectric generating facilities are not currently eligible because they do not meet the RPS hydro definition or the CEQA equivalency requirement for out-of-country resources.

Indeed, the vast majority of hydroelectric output in BC comes from facilities that have caused and/or continue to cause adverse impacts to fish, wildlife, and other components of the aquatic and terrestrial ecosystems in which they are located.

Attached please find an updated confidential draft copy of our report, *Tamed Rivers: Hydropower in British Columbia – A guide to impacts and opportunities*. Several sections have been added and amended compared to the previous version we provided, including some references to river diversion (a.k.a. "run of river") development in Norway, similar to what is occurring in BC. You are free to cite this report in your own research, and we will provide you with the final version as soon as it is ready, which we anticipate will be by the end of this month.

In addition, I would like to draw your attention to some miscellaneous points of interest not addressed in our draft report:

Recommendations for responsible clean electricity development in British Columbia

The attached document titled *Recommendations for responsible clean electricity development in British Columbia* was authored in 2009 by four well-established environmental organizations in British Columbia. These recommendations speak to the many problems with hydropower

development in BC that the study authors are aware of, and this document presents positive, realistic solutions. The recommendations were endorsed by 25 conservation groups in BC, many of them quite prominent (e.g. Sierra Club), and some of them decidedly in favour of hydroelectric development (e.g. BC Sustainable Energy Association). As one of this document's authors, it is my informed opinion that none of these recommendations have been implemented in any substantive way by BC's provincial government.

The Holmes River Hydro Project

During the workshop held on February 24, 2012, I provided the Holmes River hydro project as an example of how hydro projects entailing diversions of multiple adjacent streams or rivers within a single watershed are sometimes assessed individually to avoid triggering the 50 MW threshold for assessment under BC's Environmental Assessment Act. The attached letter to BC Hydro from several BC environmental groups outlines the specifics of that project. Our organization is now preparing to take legal action against the provincial government for issuing water licenses for this 76.5 MW hydro project without subjecting it to assessment under BC's Environmental Assessment Act. For further information we would be pleased to have you contact our legal counsel, Karen Campbell at Ecojustice (604-685-5618 ext.287; kcampbell@ecojustice.ca).

The Kokish River Hydro Project

Also during the Feb. 24 workshop, the Kokish River Hydro Project was discussed. This 45-MW river diversion project located on the Kokish and Bonanza watersheds on northeastern Vancouver Island received an environmental assessment certificate on November 24, 2011. The BC government has authorized the proponent to divert between 52-85% of the Kokish River, depending on the time of year, into a diversion pipe over a 9km stretch of river that is home to steelhead, coho, sockeye, and chinook salmon, plus trout and char. The Kokish is one of only 3 rivers on Vancouver Island that still supports a run of summer-run steelhead. More information can be found at http://savethekokish.ca/.

Testing the waters

The attached legal analysis titled "Testing the Waters" was also discussed during the Feb. 24 workshop and is attached for your convenience.

Please feel free to contact me for any further information you may require.
Phone: 250-380-1176
Email: hillfish@telus.net

Sincerely,

Aaron Hill, M.Sc.
Ecologist

RECOMMENDATIONS FOR RESPONSIBLE CLEAN ELECTRICITY DEVELOPMENT IN BRITISH COLUMBIA

Prepared by: David Suzuki Foundation, Pembina Institute, Watershed Watch Salmon Society, West Coast Environmental Law

December 17, 2009

Overview

Many British Columbians — including those deeply concerned about climate change — harbour concerns about how renewable electricity is currently planned, promoted and developed in BC. They want to see renewable electricity projects, but they want to be confident that those projects are planned and developed in a way that limits impacts and maximizes benefits for British Columbians.

While government energy and climate policies have stimulated a rapid increase in the rate of development of green electricity projects, public support for this development has not kept pace. Projects have frequently been opposed due to concerns about social, environmental, and economic costs. Governments have been criticized for a lack of land-use and regional planning; for excluding public participation in decision-making; for deficient project assessment and monitoring requirements; for concerns over project licensing; for perceptions of weak energy conservation efforts; for negative impacts on BC's long-term planning and electricity security needs; and for restructuring BC Hydro and restricting its ability to directly produce power.

We believe that it doesn't have to be this way. We believe that a green and more prosperous future for BC is still possible — and desirable. The undersigned groups believe that planning and development for clean electricity can proceed in a way that is demonstrably more transparent, strategic, and inclusive of and beneficial to all British Columbians — First Nations and the public alike — and with limited environmental impact.

We offer six basic recommendations on the direction we think government should take in clean electricity planning and development. Specifically, we believe that British Columbia's progress on clean electricity policy and development can be dramatically improved by:

1. Ensuring that energy conservation and efficiency is the highest priority.
2. Making BC's electricity supply as clean, renewable and low-impact as possible.
3. Adopting a renewable electricity planning framework that limits environmental, social, and economic impacts and maximizes public benefit.
4. Reforming water licensing, land leasing decisions and governance.
5. Strengthening the environmental assessment process, addressing and managing cumulative effects, and improving monitoring and compliance performance.
6. Developing an informed consensus about the conditions whereby renewable electricity could be exported from BC, if at all.

These recommendations are explained below.

1. MAKE ENERGY CONSERVATION AND EFFICIENCY THE HIGHEST PRIORITY

As BC's homes, buildings, and industries become more energy efficient, the province's electricity system becomes more valuable, because each kilowatt-hour of electricity is used to power more activities. Increased efficiency also gives the province more options. Every unit of electricity saved can reduce the need for new projects — or allow for new projects to power other demands. BC has made strides towards the more efficient use of electricity; however, as indicated by BC Hydro's Conservation Potential Review, there are still many untapped opportunities. Realizing these opportunities requires creative thinking and willingness on the part of the government, BC Hydro, and others to ensure that energy conservation and efficiency are the highest priority.

How to get there:

- Implement an appropriate mix of incentive programs, rate structures, and regulations so that all cost-effective opportunities to reduce electricity consumption are pursued — that is, wherever the cost of efficiency and conservation is less expensive than the full environmental, social and economic cost of new supply. This should include restoring funding to LiveSmart BC.
- Pilot innovative programs like Local Improvement Charges and Pay-as-You-Save models, and deploy them at scale as soon as possible to make it easier for families and businesses to use energy more efficiently.
- Seek new supply options only after the BC Utilities Commission has confirmed that all cost-effective energy efficiency opportunities are being pursued.

2. MAKE BC'S ELECTRICITY SUPPLY AS CLEAN, RENEWABLE AND LOW-IMPACT AS POSSIBLE

Renewable electricity is an important part of the portfolio of energy solutions needed to reduce greenhouse gas emissions. British Columbia has the ability to meet all of its domestic electricity needs for new supply through renewable sources.

How to get there:

- Require 100% of new electricity supply in BC to be clean, renewable and low-impact.

3. IDENTIFY THE BEST AND WORST AREAS IN BC FOR LOW-IMPACT RENEWABLE ELECTRICITY, AND PLAN THE PATTERN OF DEVELOPMENT ACCORDINGLY

The lack of a rigorous and transparent provincial-scale planning framework for new electricity generation projects is leading to social, environmental and economic impacts. BC has recently participated in, or undertaken, a number of energy and water planning exercises, including the Western Renewable Energy Zones initiative, the BC Utilities Commission Transmission Inquiry, and water use plans for BC Hydro facilities. Meanwhile, BC Hydro operates a separate process for deciding which Independent Power Projects (IPPs) to purchase electricity from, and the BC government has committed to the Living Water Smart program (BC's new "water plan"). These

processes will be ineffective unless they are integrated and given appropriate mandates so as to create an effective overall planning framework.

How to get there:

- Complete a provincial environmental lands screen, such as that originally developed for the Western Renewable Energy Zones process, as quickly as possible, and use it in all energy-related planning processes now underway. This will be an important first step towards systematically identifying environmentally sensitive areas and lands outside of parks and protected areas that are inappropriate for the development of renewable electricity.

- Develop a long-term land-use framework for renewable electricity with meaningful public and stakeholder participation and a meaningful and appropriate role for First Nations, to enable strategic development of renewable electricity in British Columbia. This framework must build upon and integrate with other resource management strategies (e.g. land and resource management plans, Living Water Smart); set maximum thresholds for environmental impacts in defined development areas based upon a credible cumulative effects assessment; and be implemented by means of a reformed water licensing and Crown Land lease structure incorporating project-specific environmental assessments. The form and substance of this land-use framework should be consistent with the constitutionally protected title and rights of First Nations.

- Allow BC Hydro to develop all types of clean, renewable and low impact electricity generation projects.

4. REFORM WATER LICENSING AND CROWN LAND LEASING SYSTEMS TO IMPROVE GOVERNANCE AND ENGAGE COMMUNITIES

A number of crown leases and licenses for renewable electricity projects have been issued in locations that are inappropriate for industrial development due to inadequate consideration of ecosystem, social and cultural impacts. Nominal application fees encourage proponents to acquire more multi-year licenses than they will use, blocking competitors at low cost and raising concerns for the public, who don't know which or how many sites are actually intended for development. Local communities are simultaneously overwhelmed by demands to provide comment on numerous development applications, while not being allowed to comment at all in other cases. This results in frustration and opposition to many new developments, and wastes the time and resources of citizens, governments, and industry. First Nations and the public also lack the opportunity to participate in water licensing and land leasing decisions in a meaningful way.

How to get there:

- Restrict electricity developments to appropriate zones identified by the long-term land-use framework and related planning processes discussed above. Ensure that Crown Land leasing and water licensing decisions are consistent with the outcomes of these processes, and that water licenses include mandatory instream flow requirements to sustain natural biodiversity and ecosystem integrity. No licenses should be issued in "no go" zones identified in the land-use framework and related planning processes. Existing licenses in areas deemed inappropriate in the planning process, and where projects have not yet been developed, should be revoked. All new water licenses and electricity purchase agreements should be issued based on the outcome of the provincial planning framework and regional assessment processes.

- Improve the existing system of Crown leasing and water licensing. For example:
    - In areas of the province identified as appropriate for development, give priority to renewable electricity projects with community or First Nations ownership. Incentives should be available to facilitate these models.
    - Where community or First Nations ownership is not pursued, make new licenses for large-scale developments (over 10 megawatts) in areas suitable for renewable development subject to competitive bidding.
    - Ensure that the public and First Nations have meaningful opportunities to affect project plans while details are still being formulated, and to appeal licensing and leasing decisions.
    - Place an appropriate time limit on water license applications and Crown Land investigative use permits to require careful project development within a reasonable time frame. After its expiry, the applicant would need to meet certain conditions to retain the license application and/or investigative use permit, such as demonstrating that they are investing resources into developing a project and that the site continues to be socially and environmentally appropriate.
    - Create effective mechanisms to discourage speculation, for example, by modifying the price structure of water licenses, Crown Land leases, and application fees.
    - Change the *Water Act* and water governance to require ecosystem-based minimum instream flows, protect water and watershed health, and ensure enhanced community involvement and benefits.
- Ensure and demonstrate that all electricity purchase agreements, water rental rates, and Crown land leases provide fair and equitable long-term benefits to British Columbians.
- Ensure that these reforms are designed and implemented in a manner that respects the constitutionally protected Title and Rights of First Nations.

5. STRENGTHEN AND COORDINATE ENVIRONMENTAL ASSESSMENT, MANAGE FOR CUMULATIVE ENVIRONMENTAL EFFECTS, AND ENSURE ROBUST MONITORING AND COMPLIANCE

Environmental assessments are not being conducted in a manner that satisfies public confidence or minimizes the erosion of ecosystem structure and function. Projects are assessed under narrow terms of reference, and cumulative and residual impacts of multiple electricity generation projects along with other land and water uses are not considered at the appropriate ecosystem scale or over a sufficient time horizon. British Columbians also have concerns about governments' capacity to oversee projects during construction and operation. Given the importance of healthy aquatic and terrestrial ecosystems, environmental reviews for all projects must be transparent and scientifically robust, and environmental requirements must be precautionary and fully enforced.

How to get there:

- Conduct comprehensive regional-scale cumulative environmental impact assessments for renewable electricity, consistent with our recommendations regarding land and water use

planning. Once vetted through these regional assessments and planning frameworks, suitable projects would then undergo environmental assessment prior to the issuance of any new water licenses or electricity purchase agreements.

- Revise provincial environmental assessment requirements generally to be equivalent to or better than those set out in the 2001 *Environmental Assessment Act*, including returning the threshold for site-specific environmental assessments of electricity projects to 20 megawatts.

- For all projects under the threshold for environmental assessment, enact mechanisms for transparency and public consultation that are analogous or equivalent to those required for projects that are over the threshold.

- Conduct regular, transparent, independent and verifiable audits on all electricity projects to ensure compliance with environmental regulations and license conditions, and to ensure consistency with regional-scale cumulative assessments and site-specific environmental assessment certificates. Ensure that the results of the audits are made public.

- Ensure that penalties for violations of license conditions are meaningful enough to deter purposeful violations and that resources are in place for adequate enforcement.

- Ensure that power projects are not exempted from existing environmental protections by being categorized as minor tenures.

6. DEVELOP TERMS AND CONDITIONS UNDER WHICH RENEWABLE ELECTRICITY FROM BC WOULD BE ELIGIBLE FOR EXPORT, IF AT ALL

While our generation system was not built to supply exports, the export of renewable electricity from British Columbia already occurs. Under current direction from government exports could grow significantly. A renewable electricity export strategy, similar to evolving low carbon fuel standard policies, would enable clearly planned exports of renewable electricity to other jurisdictions provided that demonstrable greenhouse gas reductions will accrue in the importing jurisdiction. The goal would be to ensure that, over time, exports of BC renewable electricity are accelerating the reduction of greenhouse gas emissions in other jurisdictions.

How to get there:

- Engage British Columbians in a meaningful public dialogue about the terms and conditions according to which existing and future exports of renewable electricity should occur, if they should occur at all, including discussion of potential NAFTA implications and energy security impacts. This dialogue should occur prior to any decision to expand power exports.

- Allow expanded exports to occur only where there will be demonstrable greenhouse gas emission reductions in the importing jurisdiction.

ENDORSED BY

BC Spaces for Nature
BC Sustainable Energy Association
Cassiar Watch
David Suzuki Foundation

Forest Ethics
Friends of Clayoquot Sound
Friends of Wild Salmon
Georgia Straight Alliance
Living Oceans Society
Northwest Watch
Outdoor Recreation Council
Pacific Wild
Pembina Institute
Raincoast Conservation Foundation
Sierra Club of Canada, BC Chapter
Skeena Watershed Conservation Coalition
SkeenaWild Conservation Trust
Steelhead Society of British Columbia
Sunshine Coast Conservation Association
T. Buck Suzuki Environmental Foundation
Watershed Watch Salmon Society
West Coast Environmental Law
West Kootenay EcoSociety
Wilderness Tourism Association
Wildsight

September 23, 2011

David Cobb
President and Chief Executive Officer
British Columbia Hydro and Power Authority
333 Dunsmuir Street
Vancouver, B.C., V6B 5R3
Sent via email to Jill Johnson, Assistant to David Cobb (jill.johnson@bchydro.com)

RE: Holmes River Hydro Project

Dear Mr. Cobb,

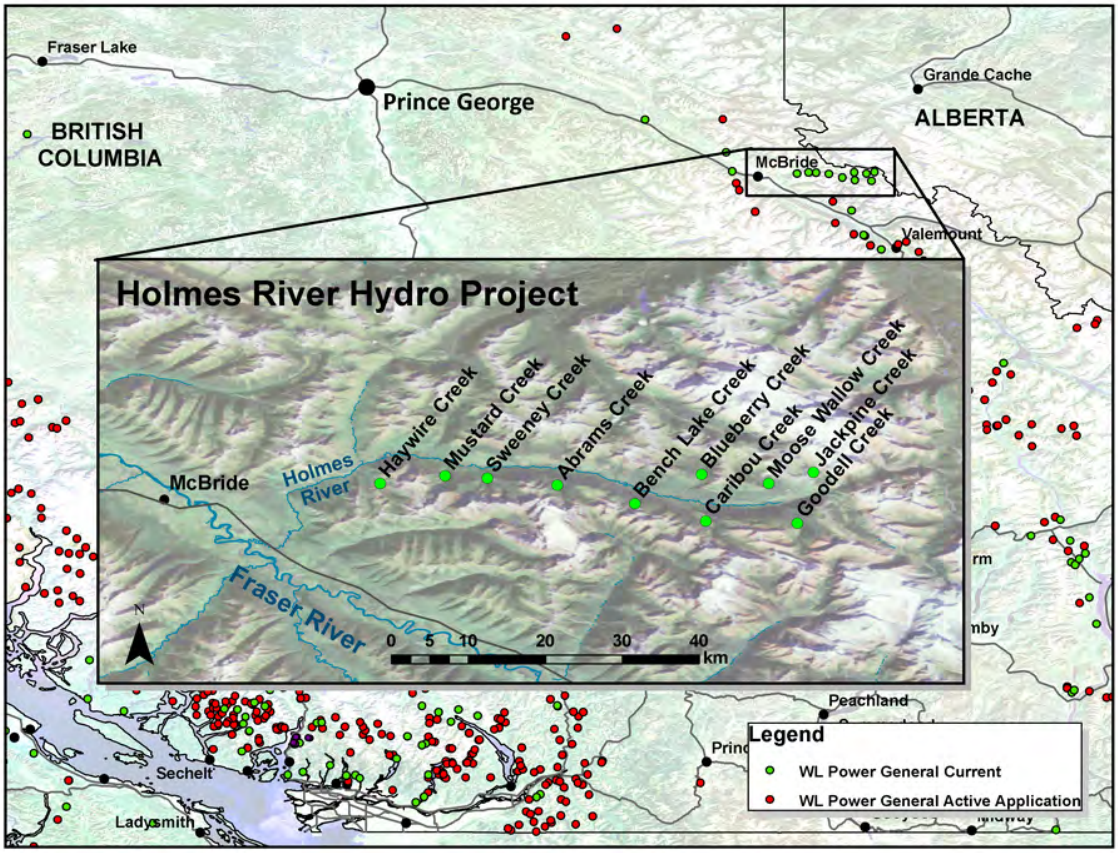
The undersigned BC conservation groups are requesting that none of the 10 proposals in the Standing Offer Program (SOP) from Holmes Hydro Inc. —collectively known as the Holmes River Hydro Project—be considered as potential candidates for Electricity Purchase Agreements under the SOP.

Section 2.5 of the posted rules for the SOP (version 2.0, January 2011) states:

> *Project Size – The following are eligible to participate in the SOP:*
>
> *· new generators with a Nameplate Capacity greater than 0.05 MW but not more than 15MW; and*
>
> *· existing generators with a Nameplate Capacity greater than 0.05MW, provided that if a Project includes an increase in the Nameplate Capacity of an existing generator, the increase in capacity must not exceed 15MW. BC Hydro will acquire energy generated from an existing generator up to a maximum of 110% of the Project Capacity or 16.5MW.*
>
> ***The SOP is intended for small energy projects. BC Hydro may reject any Application where BC Hydro determines that the Project described in the Application is so closely connected with, or related to, another Existing or Proposed Generator that the Project described in the Application and the Existing or Proposed Generator should be considered to be a single project and BC Hydro determines that the size of the combined projects is such that the Project described in the Application is not suitable for the SOP*** *[emphasis added].*

The Holmes Hydro roject is clearly intended as a clustered project, with all proposed diversions located in close proximity to each other on adjacent streams within the relatively small Holmes River watershed (see map below), and likely sharing an access road and transmission line(s).

Moreover, the enclosed letter (below) from the Proponent to the Fraser Fort George Regional District identifies this group of proposals as single project. The project is repeatedly referred to in the singular, and is introduced as "a proposed Hydro Electric Development on the Holmes watershed."



The consideration of this clustered project with its combined capacity of 76.5 megawatts is an egregious departure from the spirit and intent of the SOP: to streamline the procurement process for *small energy projects*. If BC Hydro were to continue considering this project for an EPA under the SOP, it would send a message to all BC Independent Power Producers (IPPs) that clustered projects with individual diversions of 15 MW or less are eligible under the SOP, regardless of the project's combined capacity, setting a difficult precedent for BC Hydro, and putting the legitimacy of the entire SOP at risk.

You should be aware that the approval of water licenses for the Holmes Hydro project was highly controversial. Hydropower projects with a capacity of 50 MW or

greater are required to undergo assessment by BC's Environmental Assessment Office (EAO), and it is our view that the EAO made a serious error in not subjecting this 76.5 MW project to their assessment process. The justification for the decision to not subject this project to EAO review is the subject of an active freedom of information request, and legal experts will review the results of that request.

It is imperative that existing regulatory and procurement processes are adhered to if government, industry, and BC Hydro wish for the BC public and importing jurisdictions to regard BC's private power industry as well-regulated.

Please do not hesitate to contact any of us if you require further information or discussion of this important matter.

Sincerely,

Craig Orr
Executive Director
Watershed Watch Salmon Society

Jan Dettmer
Director
BC Creek Protection Society

Jeffery Young
Biologist
David Suzuki Foundation

Rachel Darvill
Columbia Headwaters Program Manager
Wildsight

Andrew Gage
Acting Executive Director
West Coast Environmental Law

Elaine Golds
Burke Mountain Naturalists

cc. Hon. Rich Coleman, Hon. Steve Thomson, Hon. Terry Lake, Paul Kariya, John Mazure, Glen Davidson, Cam Matheson

ITEM No. 17

July 19, 2007

Regional District
Fraser Fort George
Prince George BC

Dear Representatives:

This letter is regarding a proposed Hydro Electric Development on the Holmes watershed.

We would like to provide you with information on the project and the effect this project will have on the Robson Valley.

Proponent information:

The project is being undertaken by Holmes Hydro Inc., Box 99, McBride BC. Contact: Duke Peterson at 250-569-3489 (phone, fax, and message) or email dukepeterson@telus.net.

General Background Information:

The proposal involves building 11 small hydro plants on tributaries of the Holmes River.

Entrance to the Holmes River Valley is approximately 12 KM East of McBride BC. A 55 km long forest service road and numerous skid roads give good access to the 11 tributary creeks we propose to use for power.

The individual systems are all "run of the river". No large impoundments of water are contemplated.

The total maximum power from each creek and its location along the Holmes Forestry Road are indicated in the following table. The minimum power in the winter will be approximately 10% of the following. (BC hydro uses approximately 1 KW per household as a general rule for estimating use, so the maximum production would run approximately 85000 homes)

creek names	KM location on road	KW
JR	15	7416
Tommy's	21	6262
Lauren	22	1980
Brian	24	7954
Judy	32	9339
Bench Lakes	38	2984
Blueberry	42	8157
Keith	43	11224
Kelly	52	13891
Moose	53	6571
Jackpine	55	6915
Bess(part of Jackpine)		1767
	Name plate Total kw	84466

Our proposed power line will follow the existing corridor of the road way or existing logging roads. The cutting for the power line right of way is minimal and mostly in brush growth. The power line will run approximately 55 km along the existing forestry road and connect to a high voltage line to be built along Hwy 16 from Rearguard Falls toward McBride. This high voltage line would extend approx. 50 km to where the Holmes River goes under hwy 16. This line extension will hopefully someday extend the additional 12 km into McBride.

The tributary creeks all feed into the Holmes River. The creeks are steep, have no fish, (the inlet, penstocks, powerhouses, and tailraces, are all above the fish bearing portions of the creeks) are accessible, have good volume flow, and have a large drop in elevation to the floor of the valley.

The Holmes watershed has been extensively logged and nearly all of the sites are in or near a cut block. (The cut blocks are indicated on the overall map)

For years people have known that these sites were ideal for development for hydro electric purposes but there was a lack of a power line that could receive the power! The distribution line from BC Hydro is too small to accept *any* additional power without the result of huge line losses. The addition of this system is not possible without an addition of power lines.

As a fortunate coincidence Terasen Gas has built a main transmission line extension from the Valemount Sub station that goes a long way toward our project.

Our project would provide for islanding power for the area. (Islanding is when a local source of power takes over in the event that the regular supply is severed) The project will give McBride many positive benefits.

Some of the positive things that will result from the project and a transmission line extension are:

1: A large enterprise requiring electricity could now envision settling in the Robson Valley. (The present situation is that a new enterprise might not have the quantity and reliability of power needed for production.)

2: Power outages would be reduced by the possibility of **rerouting**. If one part of the system failed the other line could be used. The occurrence of power outages is frequent at present.

3: **Islanding** power could be available in sufficient quantity to power everything in the valley. In the past there have been outages that lasted from a few hours up to several weeks. The islanding system we could provide would have been able to shorten those outages to perhaps an hour or less.

4: The construction jobs created would be in the order of 150,000 to 200,000 man hours. This would employ at least 60 people for two or three years.

5: The economic spin-off of the materials purchased, the wages, the taxes on the wages, etc. would be good for the local economy.

6: The property taxes and water use fees would be in the order of $1,600,000.00 per year to the Province and Regional District.

7: Several full time jobs would remain after the construction jobs end.

8: Income taxes will be paid corporately and individually.

9: A more secure and reliable supply of power will help avoid losses to stores and businesses that have occurred in the past few months and years. One store owner reported freezer losses of $12000 during the last outage.

10: The electricity produced will help in a small way to prepare for the shortfall in power predicted by BC hydro.

11: The electricity produced will be environmentally friendly and "green" and will offset some of the environmental problems that are associated with other types of production.

BC Hydro has projected shortfalls of power in the future for the province and has expressed the desire to provide additional power with "green" sources.

On the subject of "green", or of the environmental impact of the project:

This type of power generation offers power with the least impact that is possible to any type of generation!

The actual amount of land affected is small compared to the amount of power produced.

The water is diverted and returned to the creek without affecting the quality of the water.

The use does not consume the water.

Fish are not negatively affected. (Studies must show this before a permit will be issued)

All disturbed soil in the right of way is replanted to grasses.

The cattle pasture in the area will be augmented by the additional grass on the rights of way.

No smoke, no carbon, and no by products are produced!

The sites all have large logging areas nearby that will make the small impact even less noticeable. (On the positive side, the logging areas provide many skid roads that augment access).

Project Overview:

The systems consist of:
1- A diversion structure of concrete, rock, and earth that directs the water into a penstock.

2- A steel penstock that sends the water down the mountain to the turbines.

3- A turbine or turbines that turn the generators

4- Generators that produce electricity that is sent to the transformer substations.

5- Powerhouses that house the turbines and generators and switchgear.

6- Tailrace channels send the water back into the creek.

7- Power lines send the power to BC Hydro and ultimately to consumers.

The project construction phase may take up to 3 years.

Once completed the life of the project will be more than 40 years. The life of this type of project has been seen to be more than 80 years in some instances.

The positive economic impact will continue during the whole life of the project. The cost to the government is almost nothing once the plants begin production since it takes very little time by government employees to oversee and to collect the fees. The more intensive government supervision and overseeing during the construction period is offset by application fees.

Currently the government collects about $500,000 per year from logging in this watershed. That will come to an end in the next year or two as nearly all the timber has been cut. In the future, the replanting and road expenses will not have an offsetting income from additional harvest.

This type of project differs from logging in many positive ways. This project will begin paying around $1,600,000 per year when completed, and keep paying the fees as long as the plants are there and water runs down hill! No further costs will accrue for the government once the construction is complete.

The environmental impact after the construction is over is extremely low.

Land Use Setting:

The land used is entirely Crown land.

Consultation Activities:

Lands and Water will require that we hold information meetings with the general public.

Referrals will be sent by Lands and Water to a list of entities including First Nations, DFO, and all levels of government.

I believe the logging operator, trapper, grazing permit holder, and BC Parks will all receive referrals along with others.

We have given our MLA an information package as well.

Proposed Development Schedule:

Information has been provided with our application to Land and Water. We will commence fish studies in the spring of 2007 and continue studies during the season as directed by the Department of Environment. All the sites will be reviewed by a Geotechnical engineer as well as a biologist.

As a timeline for development we would like to have a permit in place in Oct. or Nov. of 2007. Construction of the rights of way would commence when the permits are issued. Construction of everything else would start in the spring of 2008. Completion would be in 2009.

Required Permits:

Water Licenses
Land occupation licenses
Electrical permits
Right of Ways
Cutting Permit
Log Stamp
Building permits
Septic permits
B C Hydro connection permits
DFO approval

One major necessity for our project to happen is a main transmission line must be built to connect to the 138kv line that will be at Rear Guard Falls. We feel this is a major necessity for McBride as well!

It will be necessary for the Village to make a request to BCTC (British Columbia Transmission Corporation) for the line.

We stand ready to answer any additional questions at your convenience.

We hereby respectfully request a letter of support from the Regional District for our project.

Regards,

Duke Peterson
President
Holmes Hydro Inc.

Testing the Waters

A Review of Environmental Regulation of Run of River Power Projects in British Columbia

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April 2010

Prepared by

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Associate

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The author would like to acknowledge the valuable preliminary legal research done on this issue by Sunny Zhai, Jill Vivian and Micah Carmody of the Environmental Law Centre at the University of Victoria

INTRODUCTION

The promotion of run-of-river ("ROR") projects[1] has been a key feature of the British Columbia government's plan to increase reliance on renewable sources of energy. Yet a great deal of controversy has arisen concerning the environmental footprint of these projects and whether sufficient regulatory oversight is currently in place. Government representatives and ROR proponents have defended existing regulatory processes by pointing to the large number of approvals required. In a recent letter to the California State Assembly, BC Minister of Environment, Barry Penner, asserted that a typical ROR project requires more than 50 permits, licences, reviews and approvals from 14 regulatory bodies.[2] The following report canvasses the provincial and federal environmental regulations that apply to ROR projects in BC. It focuses on those statutes and regulations that are most relevant to environmental issues, including each piece of provincial legislation and most of the federal legislation cited in Minister Penner's letter.[3] This review suggests that many of the laws and approvals referred to by ROR advocates have little if any application to the environmental impacts of a given project.[4] Further, this report identifies significant shortcomings in the key legislative provisions and review processes that do address environmental concerns. These include inadequate access to public information, a lack of clear and balanced legislative mandates to guide decision-makers, reduced regulatory thresholds for environmental assessments, as well as ineffective monitoring and compliance measures. Despite the numerous laws and agencies involved, the current regulatory regime does not afford adequate environmental protection in the context of ROR development in BC.

PROVINCIAL LEGISLATION

Land Act and *Water Act*

The Land Act[5] and Water Act[6] are the key legislative instruments governing the disposition of public resources in BC. These laws provide minimal guidance on how the environmental impacts of such decisions should be considered. What little environmental protection may be contemplated is generally left to the wide discretion of officials, and is not subject to objective, mandatory standards.

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[1] Run-of-River projects are just one type of Independent Power Project ("IPP") in British Columbia. IPPs such as wind power, solar power, and geothermal energy projects, for example, are subject to a similar but not identical regulatory regime. This report examines the regulatory framework for ROR projects, although the term IPP is used in some cases where it is more appropriate.

[2] Scott Simpson, "British Columbia Green Power Faces Battle in California," Vancouver Sun, April 1, 2009, online: http://communities.canada.com/vancouversun/print.aspx?postid=326740. See also the Independent Power Producers Association of British Columbia, Run of River Fact Sheet, online: http://www.ippbc.com/media/Run%20of%20River%20Fact%20Sheet.pdf.

[3] As reported by Simpson, *ibid*.

[4] The figure above concerning the number of regulatory approvals required for a typical project incorporates various approvals, such as warning sign placements, which have little bearing on environmental protection. In addition, a number of the statutes cited by Minister Penner do not address environmental impacts. See, for example, discussions on the *Transportation Act*, S.B.C. 2004, c. 44, and *Navigable Waters Protection Act*, R.S.C. 1985, c. N-22., below

[5] *Land Act*, R.S.B.C. 1996, c. 245.

[6] *Water Act*, R.S.B.C. 1996, c. 483.

The *Land Act* governs the disposition of provincial Crown land, which includes the foreshore and the beds of rivers and streams. Decisions on Crown land tenure are made by the Integrated Land Management Bureau ("ILMB"). Virtually all ROR projects in BC are located on Crown land. Land tenure is therefore one of the key approvals that a ROR project must obtain before any work can begin.[7]

The *Water Act* covers a range of water rights and uses, and vests ownership of and rights to surface water in the Crown. Any ROR project that involves diverting water from a stream, river or lake must acquire a "conditional water licence" issued by the Water Stewardship Division of the Ministry of Environment ("WSD").

Applications for Crown land tenure and water licences are submitted jointly. This application package contains a preliminary description of the project called a Project Scope.[8] Based on the information provided, regulatory agencies provide a checklist of objectives and information requirements that the proponent can use to prepare its final application, called a Project Development Plan. Proponents must prepare an Environmental Impact Assessment, which is a report that describes how anticipated environmental impacts will be addressed.[9] Once the Project Development Plan is submitted, the regulatory decision to approve, reject or place conditions on the tenure or licence is made (by ILMB for land tenure and by WSD for water licences).

Concerns about environmental regulation under the *Land Act* and *Water Act*:

1. Inadequate Public Notice and Information Disclosure

- **Public notification is ineffective and delayed.** There is no legal requirement to notify the public of new ROR applications.[10] Public notification is often not provided until late in the land tenure adjudication process. After the application package is complete, project information is posted on government websites, but no public notification of the posting is given (e.g. in local newspapers or the *Gazette*).[11] Furthermore, land tenure applications

[7] There are various forms of Crown land tenure, including investigative use permits, temporary permits, works permits, licences of occupation, leases, rights of way, and easements. This report focuses primarily on Crown land leases, which provide a right of occupation, typically for 30 to 45 years.

[8] *Independent Power Production in B.C.: An Inter-agency Guidebook for Proponents*, Ministry of Agriculture and Lands (September 2008), online: http://www.al.gov.bc.ca/clad/IPP_guidebook.pdf ("IPP Guidebook"). The Project Scope includes: an executive summary; the proponent identification; the project concept; the capacity of project; linkage with other projects; the market for electricity; a schedule for completion of project; and, a section addressing any impacts *(IPP Guidebook*). The Project Scope was formerly known as the Preliminary Project Description.

[9] Environmental Impact Assessments ("EIAs") should not be confused with provincial or federal environmental assessments, which are different regulatory processes discussed below. EIAs are reports prepared by the proponent (or its consultants) which describe how the proponent plans to address environmental issues such as instream flows, wildlife habitat, water quality, roads, bridges, flood control, and hazards to the environment. (IPP Guidebook, *ibid.* at 98).

[10] Note that the public notice contemplated by s. 33 of the *Land Act* is subject to the Minister's discretion. As is the notice provision in s. 3(1) of the *Water Regulation*, B.C. Reg. 19/2010.

[11] *ILMB Decision Database*, http://www.arfd.gov.bc.ca/ApplicationPosting/index.jsp, and *Water Licences Query Database*, http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input. Concerned citizens and organizations must search government databases on a regular basis if they wish to keep abreast of project proposals (*Improving the opportunities for public involvement in the Crown land tenure and water licence approval process for run-of-river*

are only posted for about 6 months after a final decision is made, effectively barring the review of past land tenure decisions made by ILMB.[12]

- **Key information is withheld from public scrutiny.** Initial applications are never posted. Nor are the government's preliminary reports on this information. Completed applications are often redacted, disclosing only maps without the accompanying preliminary project description.[13] For projects with less than 50 megawatts nameplate capacity,[14] the Project Development Plan is similarly withheld from the public. The only opportunity for public access to this information is through Freedom of Information ("FOI") requests. But FOI requests are time consuming, often face long delays, and may prove futile if government agencies deem disclosure a potential risk to the financial interests of the proponent or other third-parties.[15]

2. Crown Land Tenure Decisions Lack Clear Mandate to Consider Environment

- The *Land Act* does not provide environmental factors that must be considered in tenure applications. It gives no detailed guidance on whether or how to assess issues such as environmental impacts, land use suitability, or cumulative effects.[16]
- The government has drafted a Strategic Policy on Crown Land Allocation Principles,[17] but the extreme breadth of these principles renders them of no useful guidance to decision makers.[18] Further, as a policy document, it is not legally binding on decision makers.
- ILMB has provided, upon request, a list of other factors which it considers relevant to

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electrical generation projects in British Columbia, West Coast Environmental Law (December 2009), online: http://www.wcel.org/sites/default/files/publications/IPP%20water%20license%20 and%20land%20leases.pdf ("Improving Opportunities").

[12] Improving Opportunities, *ibid.* at 7.

[13] *Ibid.* at 6.

[14] That is, waterpower projects not subject to the BC *Environmental Assessment Act*.

[15] In BC, FOI requests can take an excessive amount of time. Projects involving third parties, such as IPPs, have taken up to five years to process. See for example the IBM case "Liberals must divulge contents of lucrative contract awarded to IBM", *Vancouver Sun*, online: http://www.vancouversun.com/Liberals+must+divulge+contents+lucrative+contract+awarded/2328989/story.html. If a request will cause significant harm to the financial interests of the third party, then the government is prohibited from releasing the requested information (see s. 21 of the *Freedom of Information and Protection of Privacy Act*, R.S.B.C. 1996, c. 165 ["FOIPPA"]). The third party can also object to the release of information, in which case, any information sought will be further delayed (FOIPPA, s.23). Perhaps most importantly, reduced funding to many ministries and to the Office of the Information and Privacy Commissioner ("OIPC") has caused increased delays and reduced oversight (see for example Keith Reynolds, "How Does BC Rank on Openness and Accountability? The Government's Approach to the Auditor General and Access to Information", Canadian Centre for Policy Alternatives (September 2006), online: http://www.policyalternatives.ca/newsroom/news-releases/bc-lags-rest-canada-funding-public-watchdogs. For a review of the illegally lengthy delays, extraordinarily high fees and redaction of information that are commonplace with the current provincial FOI system, see the Environmental Law Clinic submission to the Legislative Committee concerned with FOI issues at http://www.elc.uvic.ca/press/FOI-submissions.html.

[16] *Land Act, supra* note 6, s. 11(3).

[17] "Crown Land Allocation Principles", online: http://www.al.gov.bc.ca/clad/leg_policies/policies/allocation_principles.pdf ["Crown Land Allocation Principles"].

[18] As an example, under the heading "Considerations for the Decision Maker: Crown Land Values are Managed to the Benefit of the Public", the document states: "Decisions should consider social, economic and environmental outcomes that may ensue as a result of an allocation of Crown land. Benefits may be short or long term, direct or indirect." *Ibid*.

Crown land tenure decisions, but these factors are not listed in any publicly available policy document and it is unclear what obligation, if any, decision makers are under to consider them.[19]

3. Water Licence Decisions Lack of Clear Mandate to Consider Environment

- The *Water Act* was first enacted in 1909. As a creature of this bygone era, its focus is on the disposition of quantities of water in exchange for government fees. It provides little to no direction on environmental issues such as stream health or water conservation.
- Water licences are issued on a "first in line, first in right" basis.[20] This policy encourages proponents to apply for more licences than they can reasonably expect to use.[21]
- Licence decisions must account for the interests of the application, licencees, land and riparian owners, and other applicants. There is no clear legal obligation to consider regional or local land use plans, stream health, cumulative effects, or other environmental factors.[22]

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[19] In response to an email by West Coast Environmental Law, an ILMB representative suggested that the following factors were considered by decision makers in Crown land tenure applications:

- the provisions of the *Land Act*,
- the Crown Land Allocation Principles, (*supra* note 18)
- "Strategic Support for Land Use Planning" documents, (http://www.agf.gov.bc.ca/clad/strategic_land/lup_support.html)
- approved local and regional plans,
- the rules for 'establishment and use' found in any applicable Crown land designations, such as parks, protected areas, special use zones, reserves and old growth management areas,
- other government agency perspectives including local, provincial and federal,
- comments and concerns of the local First Nation(s),
- comments from other tenure holders who may be affected, and
- public input.

"Improving Opportunities", *supra* note 12 at 13.

[20] *Water Act*, *supra* note 7 at 15.

[21] Only when multiple water licences are issued on the same day do the respective rights take precedence according to their purposes. In times of water shortage, the licensee with an earlier water licence is allowed to take as much water as is stipulated in its licence before a late-comer licensee is allowed to take any ("Improving Opportunities", *supra* note 12). When there are two licences issued on the same date and to the same stream, the allocation is prioritized according to the purposes of the licences, with the following rank: "domestic, waterworks, mineral trading, irrigation, mining, industrial, power, hydraulicking, storage, conservation, conveying and land improvement purposes." Conservation, it should be noted, ranks second to last of the 12 contemplated uses. *Water Act, ibid.*, s. 15(2).

[22] The only provision in the Act to even remotely contemplate environmental impacts is section 12, which says that the decision maker "may" refuse or amend a licence that is inconsistent with an approved resource management plan. When questioned by West Coast Environmental Law on the factors relevant to licence decisions, WSD stated that water licence decisions are based on Technical Assessments which are prepared by WSD staff and summarize the specifications, comments, and potential impacts in relation to the project. One Technical Assessment reviewed by West Coast Environmental Law contained information about the following issues: "water reserves, lands affected by the proposed works, existing water licences on the watercourse, riparian rights, other affected landowners, fishery flow and environmental impact on water resources, wildlife habitat, flood control, recreation, other potential uses of the water, transportation, hazard to the public, impact on Crown land-owned resources, aesthetic values, First Nations consultation, public consultation and interest, and socio-economic effects." However, as stated below, the lack of publicly available documents setting out the relevant considerations, and WSD's refusal to provide written reasons for licence decisions, effectively prevent the public from understanding the factors which led to the decision in a given instance.

- The Environmental Appeal Board ("EAB") has recognized that some environmental issues such as impacts to fish instream flows are *relevant* to water licence decisions, but the WSD is not *required* to consider these factors.[23] In addition, the EAB has held that the project's land-based cumulative impacts and community opposition are *not* relevant considerations in deciding whether a water licence should be issued.[24]
- Licences cannot be amended for water conservation. As long as the licencee abides by the Act and the terms of the licence, the Act does not provide authority to amend licences to reduce the quantities of water provided.[25]

4. Reasons for Tenure and Licence Decisions are Inadequate or Non-Existent.

- The ILMB posts written reasons on its website for decisions on Crown land tenure applications. However, these reasons tend to be short and shed little light on *why* the decision was made or the factors considered.[26]
- The WSD does not issue *any* reasons at all for its decisions on water licences.
- Without full explanation of tenure and licence decisions, especially in light of the lack of detailed legislative or policy guidance, the regulatory process appears secretive. This lack of transparency has fed growing concerns about whether land tenure and water licence decisions are, in fact, based on a thorough and consistent consideration of the relevant environmental impacts.[27]

5. Insufficient Grounds and Procedures for Appeal

- The internal appeal provisions under the *Land Act* are procedurally unclear, impractical, and subject to the broad discretion of the Minister.[28]

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[23] *Planedin v. Deputy Comptroller of Water Rights*, EAB Decision No. 2006-WAT-012(a) at 19-20, online: www.eab.gov.bc.ca/water/2006wat012a.pdf .

[24] *Ibid*. Also see "Improving Opportunities", *supra* note 12.

[25] Section 18(1) sets out the purposes for which a licence may be amended, which are to:

(a) extend the time set for beginning construction of the works;
(b) extend the time set for completion of the works;
(c) extend the time set for making beneficial use of the water;
(d) authorize additional or other works than those previously authorized;
(e) correct an error in the licence;
(f) remove a provision of the licence that is inconsistent with this Act;
(g) authorize the use of water for some purpose other than that specified in the licence;
(h) extend the term of the licence;
(i) increase or reduce the quantity of water authorized to be diverted or stored if it appears to have been erroneously estimated.

Note that s. 18(1)(i) only allows a reduction in quantity where there has been an "error" in the quantity of water estimated. It is not immediately clear what might constitute such an error. Arguably, this provision would presumably not apply when the cumulative effects of previously issued water licences were not considered, or in circumstances where such measures were considered but were not determinative.

[26] This is based on the review of ILMB decisions conducted by West Coast Environmental Law in "Improving Opportunities", *supra* note 12 at 15.

[27] Some critics have alleged that impacts to fish, wildlife and the overall ecosystem are only considered by the WSD in a "best-case scenario". See Tanis Douglas, *"Green" Hydro Power – Understanding Impacts, Approvals, and Sustainability of Run-of-River Independent Power Projects in British Columbia,* Watershed Watch Salmon Society (August 2007), online: http://www.rivershed.com/documents/green_hydro_power.pdf ("'Green' Hydro Power").

[28] Section 63 of the *Land Act*, *supra* note 6, sets out the procedure for registering an objection to the disposition of a

- WSD water licence decisions may be appealed to the BC EAB, but only by the applicant, directly affected land owners, riparian owners[29], or other licensees or applicants.[30] There is no general right of appeal to the public or organizations representing the public interest.

6. Monitoring and Enforcement of Conservation Measures is Rare

- Government officials are authorized to inspect project sites and issue penalties for contraventions of the Act, regulations, or terms of a licence. However, funding for monitoring and enforcement of environmental protection has declined rapidly since the 1990s. This has been seen through downsized budgets for environmental ministries and by reductions in the number of conservation officers.[31]
- Fines are rare. If issued at all, they have been for amounts as little as $230.[32]

Utilities Commission Act

The *Utilities Commission Act*[33] sets out the powers of the Utilities Commission (the "Commission") to regulate pubic utilities in BC. To meet the goals set out in the Government's Energy Plan,[34] BC Hydro plans to purchase large quantities of power from ROR projects. BC Hydro manages a competitive bidding process among IPPs for awards of Electricity Purchase Agreements ("EPAs"). EPAs are subject to regulatory review by the Commission under s. 71 of

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Crown land tenure. Any person may submit a written notice of objection to such a disposition. However, the notice must be submitted *before* the disposition is made. Given the inadequate notice and information disclosure, this is highly impractical. Second, the Minister has *absolute discretion* on whether to hold a hearing to consider the objection. There are no factors to guide how discretion should be exercised in such decisions. Third, if a hearing is held and a report issued, the only obligation on the statutory decision maker is to "review" the report and "take account" of its recommendations. He or she *may* (or may not) then make an order setting out what is deemed "just" in the circumstances. Section 64 of the *Land Act* provides that only an "affected person" (i.e. likely only the applicant, a land owner, riparian owner, licencee or other applicant) may appeal such an order, and even then only on a point of law. Once Crown land tenure has been issued (i.e. the time for s. 63 objections has passed), the only other alternative would be to judicially review the tenure decision. However, in addition to the considerable time expense involved in such proceedings, members of the general public or public interest organizations may be considered not to have a direct interest and therefore be denied standing.

[29] That is, owners of land adjoining the water body in question.

[30] *Water Act*, *supra* note 7, s. 92(1).

[31] According to a report by West Coast Environmental Law, enforcement actions declined by over 50% between 1995 and 2005, and written warnings (as opposed to fines or other legal actions) were increasingly relied upon. Major funding cutbacks also occurred during the same time period, and may be a factor in the decline. For example, the Compliance Policy and Planning Branch, of the Ministry of Environment, responsible for "ministry-wide leadership and service in support of a strategic approach to compliance management", has only four full time staff positions. See "No Response: A survey of environmental law enforcement and compliance in BC", West Coast Environmental Law (2007), pages 24-26, online: http://wcel.org/sites/default/files/publications/No%20Response%20-%20A%20survey%20of%20environmental%20law%20enforcement%20and%20compliance%20in%20BC.pdf.

[32] In a review of the quarterly reports for 2007, 2008, and the first two quarters of 2009, only three tickets were issued for breaching the terms or conditions of a licence/authorization/permit under the *Water Act*. Furthermore, the fines issued were for paltry amounts. Husky Oil, for example, was fined $230 for its contravention. .

[33] *Utilities Commission Act*, R.S.B.C. 1996, c. 473.

[34] The BC Energy Plan is available on the government of BC website: http://www.energyplan.gov.bc.ca/.

the Act.[35] In addition, construction or expansion of uutility plants or systems (e.g. to supply power acquired from IPPs) may require Commission approval through a Certificate of Public Convenience and Necessity ("CPCN") under s. 45 of the Act.

Concerns with the *Utilities Commission Act*

- **Key approvals must adhere to pro-ROR government policy.** In 2008, the government introduced legislative amendments to streamline regulatory approvals of IPP projects.[36] The Act now requires the Commission to ensure that CPCNs and EPAs are consistent with the government's energy objectives.[37] These objectives include important environmental considerations like the reduction of greenhouse gas, investment in innovative technology, and the promotion of "clean or renewable energy", but do not refer to potential environmental impacts of additional "clean energy" generation such as compromised wildlife habitat or reduced water quality.[38] Coupled with the anticipated increase in electricity demand,[39] these measures create an unbalanced regulatory foundation in favour of ROR expansion, leaving key environmental impacts outside of the scope of the Commission's review.
- **The Act allows exemptions from key regulatory approvals.** The Minister may provide exemptions from CPCNs or EPA approvals.[40]
- **Local government authority has been effectively abolished.** After concerns with impacts to grizzly populations and planning gaps prompted a BC regional district to oppose a ROR project in 2006, the government amended section 121 of the Act to effectively abolish local authority over ROR projects.[41] The BC government still has a

[35] On March 11, 2010, BC Hydro chose 19 IPP projects for an award of energy purchase contracts, pursuant to its Clean Power Call issued on June 11, 2008. See BC Hydro website: http://www.bchydro.com/planning_regulatory/acquiring_power/clean_power_call.html.

[36] See Bill 15 – 2008, *Utilities Commission Amendment Act*, 2008. Online: http://www.leg.bc.ca/38th4th/1st_read/gov15-1.htm

[37] Section 1 of the *Utilities Commission Act*, *supra* note 34, defines these objectives as follows:

> (a) to encourage public utilities to reduce greenhouse gas emissions;
> (b) to encourage public utilities to take demand-side measures;
> (c) to encourage public utilities to produce, generate and acquire electricity from clean or renewable sources;
> (d) to encourage public utilities to develop adequate energy transmission infrastructure and capacity in the time required to serve persons who receive or may receive service from the public utility;
> (e) to encourage public utilities to use innovative energy technologies
> (i) that facilitate electricity self-sufficiency or the fulfillment of their long-term transmission requirements, or
> (ii) that support energy conservation or efficiency or the use of clean or renewable sources of energy;
> (f) to encourage public utilities to take prescribed actions in support of any other goals prescribed by regulation;

[38] Furthermore, the Act requires CPCNs and EPAs to be consistent with the government's goal of deriving 90% of BC power from sources of clean energy (*Ibid*., ss. 64.01, 64.02).

[39] BC Hydro projects an approximate 1.4% annual increase in electricity demand in BC over the next 20 years. See BC Hydro website: http://www.bchydro.com/planning_regulatory/meeting_demand_growth/forecasting_growth.html

[40] *Utilities Commission Act*, *supra* note 34, ss. 22, 88.

[41] In 2006, the Squamish-Lillooet Regional District denied zoning approval for the Ashlu River IPP project proposed by Ledcor Inc. (J. Calvert, *Liquid Gold: Energy Privatization in British Columbia* (Fernwood Publishing:

policy of consulting local governments on ROR projects, but the Province retains sole jurisdiction over Crown land tenure, water licences, and utilities approvals.[42]

Forest Act and *Forest and Range Practices Act*

The *Forest Act*[43] and the *Forest and Range Practices Act* [44] ("FRPA") are the two main pieces of legislation governing forestry activities in British Columbia. They determine the licencing, permitting, and planning requirements for logging, incidental forest practices (such as clearing, road building, and reforestation), and other development on forest and range lands.

The use or construction of roads on forest land may obligate ROR project proponents to obtain approvals from the Ministry of Forests and Range ("MOFR").[45] Before issuing such approvals, MOFR officials are typically required to consider a broad scope of potential environmental impacts such as landslides, fan destabilization, soil disturbance, or deposits of sediment or harmful substances into streams, lakes, or wetlands.[46]

Concerns about the application of forestry legislation to ROR projects:

- **Minor tenures exempt from environmental protections**. Some licences that ROR proponents must obtain are exempt from key legislative protections. Occupants Licence to Cut ("OLTC") are defined as minor tenures.[47] Holders are not required to prepare Forest Stewardship Plans, and can be exempted by MOFR regional or district managers from practice requirements regarding soil protection, riparian areas, forest health, watersheds, biodiversity, and wildlife protection.[48]

2007), at pg 175). Bill 30 subsequently amended s. 121 of the *Utilities Commission Act* such that no decision of a local government "… supersedes or impairs a power conferred on the commission or an authorization granted to a public utility". Because CPCNs may be required for public utilities such as BC Hydro to use ROR power, the amendment of s. 121 of the Act allows the Commission to ignore or override local government land use decisions regarding ROR projects.

[42] Minister Richard Neufeld's speech to the IPPBC AGM (June 7, 2006); Minister Neufeld, Debates of the Legislative Assembly (May 15, 2006 Afternoon Sitting), online: http://www.leg.bc.ca/hansard/38th2nd/H60515p.htm#bill30-3R. Moreover, nearly all ROR projects are located on Crown land and thereby fall outside the geographical jurisdiction of local governments.

[43] *Forest Act*, R.S.B.C. 1996, c. 157.

[44] *Forest and Range Practices Act*, S.B.C. 2002, c. 69.

[45] An Occupant Licence to Cut authorizes the holder to cut Crown timber. A Road Use Permit authorizes the holder to use a Forest Service Road for industrial purposes or to construct/modify the road. A Works Permit allows the holder to carry out works within a Forest Service Road right-of-way. Finally, a Third Party Road Use Agreement allows the holder to use the road in situations where an industrial user already has a Road Permit for Non-Forest Service Roads (IPP Guidebook, *supra* note 9).

[46] MOFR Design Criteria for Works that May Impact Forest Roads or Timber Tenure, Online: Ministry of Forests and Range, July 2005 http://www.for.gov.bc.ca/hth/engineering/documents/publications_guidebooks/publications_reports/MOF-IPP-Design-Criteria_July7-05_.pdf.

[47] *Forest Practices and Planning Regulation,* B.C. Reg. 4/2010, s. 1 "minor tenure".

[48] FRPA General Bulletin, "Application of FRPA to Independent Power Producers, Mineral Interests and Other Occupiers of the Land, No.16 (September 9, 2008), online http://www.for.gov.bc.ca/dck/Tenures/FRPA_gen_bulletin_16.pdf, at 2.

- **Key wildlife protections have been effectively repealed**. Many ROR projects occur in areas of critical wildlife habitat where activities such as forest clearing or road building are prohibited under the FRPA by designations called General Wildlife Measures ("GWMs"). To proceed, project proponents therefore require an exemption from applicable GWMs. In February 2008, the Ministry of Environment issued a Decision Note stating that if an Environmental Assessment certificate has been granted, FRPA officials *must grant proponents an exemption to otherwise applicable GWMs*.[49] This policy fetters the discretion of MOFR officials and, in effect, repeals one of the few existing legal protections in BC for at-risk species.
- **Excessive logging occurs**. Government inspection reports indicate that right-of-way logging by ROR proponents has occurred in excessively wide swaths in old-growth forests—up to four times what was agreed to in management plans.[50]
- **Wildlife protection under the FRPA has been poor in the past**. The most endangered bird in Canada is the Spotted Owl. They live only in BC, where there are less than 20 left in the wild. Nonetheless, the BC government continues to authorize logging in their habitat, despite recommendations in 2003 and 2007 by the Spotted Owl Recovery team to ban further habitat destruction.[51]

Environmental Assessment Act[52] (BC)

Certain major projects within British Columbia must undergo an environmental assessment ("EA"), a process overseen by the Environmental Assessment Office in accordance with the BC *Environmental Assessment Act* ("EAA"). A provincial EA is triggered by certain thresholds set out by regulation,[53] whereas federal environmental assessments (discussed below) are triggered if a project requires federal money, land, or approvals.

Concerns about the BC EAA:

- **Legal protection has been weakened.** The Act, which came into force in 1996, was rewritten in 2002 in what has been described as "a dramatic step backward for environmental assessment in British Columbia."[54]
- **Project thresholds are too high**. The 2002 amendments increased thresholds for the review of hydroelectric power plants (and associated water diversion projects) from 20

[49] Ministry of Environment Decision Note, February 25, 2008, File: 280-20. The Note was approved on March 18, 2009 by the Deputy Minister of Environment.

[50] See Cloudworks Energy Inc.'s response to the Ministry of Environment's IPP Inspection Team Findings, April 9, 2009, online: http://www.cloudworksenergy.com/PDF/CEI_Responses_to_MOE_Audit_9April2009.pdf.

[51] See Faisal Moola et al., "Rich Wildlife Poor Protection: The Urgent Need for Strong Legal Protection of British Columbia's Biodiversity", David Suzuki Foundation and Sierra Legal (2007), online: http://www.davidsuzuki.org/Publications/Rich_wildlife_poor_protection.asp, at 10. See also the ELC and Sierra Legal Letter to the Minister of Environment et al., "Re: *Wildlife Act* Review" (July 18, 2007), online: http://www.elc.uvic.ca/documents/letter%20-%20Wildlife%20Act%20Review.pdf, at 3.

[52] *Environmental Assessment Act*, S.B.C. 2002, c. 43.

[53] *Reviewable Projects Regulation,* B.C. Reg. 4/2010.

[54] "Deregulation Backgrounder: Bill 38 – The New Environmental Assessment Act", West Coast Environmental Law, (May 15, 2002; updated November 2, 2004), online: http://wcel.org/resources/publication/deregulation-backgrounder-bill-38-new-environmental-assessment-act ("Deregulation Backgrounder").

megawatts to 50 megawatts. As a result, a large proportion of ROR projects do not undergo EAs.[55] Thresholds are also very high for electrical transmission lines. The current threshold is 500 kV. As a result most IPP transmission lines will not trigger a provincial EA, even where the transmission lines are located in an old growth management area or critical wildlife habitat.[56]

- **Provincial EAs are subject to political discretion.** The EA process is now directed by government policy and subject to broad political discretion.[57] The Executive Director of the Environmental Assessment Office can 'waive' the EA requirement if he or she considers that the project will not have significant adverse effects.[58] The meaningful participation of First Nations, local governments, and other stakeholders is no longer guaranteed, but is instead subject to the discretionary application of government consultation policies.[59] Public access to EA documents is guided by the same policy regulation and subject to the Executive Director's sole discretion.[60] And, the discretion for ministers to approve an EA certificate application is unstructured and unbounded by substantive criteria.[61]
- **The EAA process is not objective.** Where the former Act contained a purposes section to guide the EA process, the current Act is silent.[62] Moreover, section 11(3) of the EAA

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[55] This determination was made based on data obtained from the Independent Power Producers of BC website suggesting that 50 out of 58 small hydro projects proposed since 2003 were less than 50MW. In some cases, where two or more ROR projects are located in close proximity to each other, these projects may be "clumped" together and undergo an EA collectively if their cumulative output is greater than 50MW. See http://www.ippbc.com/EN/bc_ipp_map/.

[56] *Reviewable Projects Regulation, supra* note 54, s. 9.

[57] For example, ss. 11 and 14 of the EAA give the Executive Director or Minister the discretion to determine the scope of the assessment.

[58] *EAA, supra* note 53, s. 10(1)(b)(ii).

[59] *Public Consultation Policy Regulation*, B.C. Reg. 373/2002. Under the former Act, a project committee consisting of federal, provincial, First Nation, and local representatives would guide the process, identifying information requirements and determining the scope of review.

[60] *EAA, supra* note 53, ss. 11, 25.

[61] The BC Court of Appeal has described the broad discretion of the minister to grant an EAC under the current Act as follows: "I see the ministerial review as a wrap-up decision, where two ministers have unconstrained discretion to prevent a proposed activity, public or private, for profit or not-for-profit, that has potential "adverse effects" from going forward. The Act does not specify effects on whom or what." (*Kwikwetlem First Nation v. British Columbia (Utilities Commission)*, 2009 BCCA 68, at para. 57). In *Do Rav Right Coalition v. Richmond/Airport/Vancouver Rapid Transit Line Project and RAV Project Management Ltd.* 2005 BCSC 991, Bauman J. (at para. 34) characterized the minister's discretion thus: "…at the end of the process, a political, policy-driven decision is made by elected Ministers of the Crown; they are given a very broad discretion to consider the issue: they may consider "any other matters that they consider relevant to the public interest in making their decision on the application." The breadth of this discretion fails to guarantee that environmental factors will be given due weight.

[62] The former *Environmental Assessment Act,* R.S.B.C. 1996, c. 119, included a purposes section that stated: "The purposes of this Act are

(a) to promote sustainability by protecting the environment and fostering a sound economy and social well-being,
(b) to provide for the thorough, timely and integrated assessment of the environmental, economic, social, cultural, heritage and health effects of reviewable projects,
(c) to prevent or mitigate adverse effects of reviewable projects,
(d) to provide an open, accountable and neutrally administered process [...]
(e) to provide for participation, in an assessment under this Act, by the public, proponents, first nations, municipalities and regional districts, the government and its agencies, the government of Canada and its

requires the assessment itself to reflect government policies. This could make what should be a scientific review of the potential environmental impacts of a project subject to the current policy goals of the provincial cabinet, such as expanding hydroelectric power into remote communities.[63]

- **No regional or cumulative assessment.** There is no requirement under the Act for regional assessments of cumulative impacts from ROR projects and other resource-based industries in the area. This is surprising given that the ostensible purpose of an EA is to ensure that the potential environmental and socio-economic impacts of major projects within the province are understood and accounted for. As a result, cumulative effects of ROR projects will go un-checked unless the federal Canadian Environmental Assessment Act is also triggered, as discussed below.
- **No mandatory review of alternative sites and methods.** The 2002 Act repealed the previous statutory provisions that required evaluation of alternative sites and methods to the proposed project. Now the 2007 EAO Guide to Preparing Terms of Reference states that a number of issues only need to be addressed if a project triggers a federal environmental assessment: these issues include the assessment of alternative means of carrying out the project, cumulative environmental effects, the potential for accidents and malfunctions and natural hazards to the project.[64]
- **Inadequate monitoring and compliance with EA commitments.** Proponents may make commitments to mitigate environmental impacts under the EA process, but monitoring of such commitments can be inadequate, as can actual compliance.[65]

Fish Protection Act

The BC government introduced the *Fish Protection Act*[66] in 1997. Among other measures, the Act contemplates the protection of threatened fish populations through the designation of "sensitive streams" and the development and imposition of associated recovery plans.

Concerns about the *Fish Protection Act:*

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agencies and British Columbia's neighbouring jurisdictions.
These provisions were removed when the Act was rewritten in 2002.

[63] BC's Energy Plan affirms the government's support for BC Hydro's remote community electrification program, as well as a commitment for 3000 gigawatt hours of electricity on top of the firm energy requirements, to be obtained from net-zero greenhouse gas emissions projects. See http://www.energyplan.gov.bc.ca/PDF/BC_Energy_Plan_Electricity.pdf.

[64] Environmental Assessment Office. A Guide to Preparing Terms of Reference for an Application for an Environmental Assessment Certificate. (Victoria: Environmental Assessment Office, 2007), online: http://www.eao.gov.bc.ca/guide/tor/Guide%20to%20Preparing%20Terms%20of%20Reference%20Sept07.pdf. By contrast, several jurisdictions require the consideration of alternative project locations or alternatives to the project itself as a mandatory feature of environmental assessment. For example, see International Institute for Environment and Development. A Directory of Impact Assessment Guidelines, second edition. (Nottingham: International Institute for Environment and Development, 1998) and the US National Environmental Policy Act, Sec. 102 [42 USC § 4332].

[65] "Independent Power Producer (IPP) Projects in British Columbia: Backgrounder", West Coast Environmental Law (May 2009), online: http://wcel.org/resources/publication/independent-power-producer-ipp-projects-british-columbia-legal-backgrounder, at 14. Also see note 32, above, which discussed the general decline in environmental enforcement actions in BC.

[66] *Fish Protection Act,* S.B.C. 1997, c. 21.

- **Many key provisions of the Act are not in force,** and require a provincial cabinet order to become law. For example, section 5 would grant the Minister authority to consider fish when issuing *Water Act* licences and approvals.[67] Section 8 would allow water licences to be issued to community groups for the purpose of protecting instream flows.[68] These provisions would provide tangible solutions to conservation concerns, and enhance regulatory integration. But the government has not announced any intention to bring these (or other) provisions into force.
- **Provisions in force have not been given full effect**. To date, only two streams have been designated and remediated under the Act's recovery planning process. Despite widespread concern regarding provincial fish populations and stream health, there are no current plans for further action under this provision.[69]
- **Regulations under the Act also contain weaknesses.** The *Riparian Areas Regulation* includes streamside protection directives, but the regulation itself only applies to projects within regional districts. Because most ROR projects occur on Crown land, the Regulation cannot be applied. In addition, the amendment of s. 121 of the *Utilities Commission Act* (discussed above) effectively repeals local government regulation.[70]

Wildlife Act

British Columbia is one of only two provinces in Canada with no law to specifically protect endangered species.[71] The *Wildlife Act*[72] is predominantly concerned with the regulation of hunting in BC. The Act does, however, contain some provisions respecting endangered species. It allows the Minister, with permission of Cabinet, to designate Wildlife Management Areas ("WMAs"). The Act also allows Cabinet to designate, by regulation, endangered or threatened species.

Concerns about the *Wildlife Act:*

- **Species-protection provisions are rarely used.** Only one threatened and three endangered species have been designated under the Act, although dozens are recognized by the BC Ministry of Environment and under the federal *Species at Risk Act*.[73] The

[67] *Ibid.*, s. 5 (not yet in force).

[68] *Ibid.*, s. 8 (not yet in force).

[69] Personal communication with Jeff Hoyt, BC Ministry of Environment, February 18, 2010.

[70] For another example, the *Sensitive Streams Designation and Licensing Regulation*, B.C. Reg. 89/2000, prohibits the construction of new dams on 15 streams but arguably has had little real effect. When the Act was passed there were no proposals to build dams on any of these streams, and no new streams have been designated since 2000.

[71] The other is Alberta.

[72] *Wildlife Act*, R.S.B.C. 1996, c. 488.

[73] Two mammals and two birds are listed under Schedules D and E of the *Designation and Exemption Regulation*, B.C. Reg. 168/90. By contrast, the Ministry of Environment lists 28 mammals and 40 birds on its "red list", a list of extirpated, endangered, and threatened species and subspecies (based on information accessed on February 16, 2010; see http://www.env.gov.bc.ca/atrisk/red-blue.htm). The federal *Species At Risk Act* lists approximately 11 mammals and 16 birds in BC as endangered or threatened, and one mammal as extinct (based on information accessed on February 16, 2010, online: http://www.sararegistry.gc.ca/sar/index/default_e.cfm). The Wildlife Act's *Designation and Exemption Regulation* does however list dozens of species as 'game', 'small game', 'big game' and 'fur-

species-protection under the Act will, therefore, have at best only an occasional influence on the regulation of ROR projects within the Province.

- **No mandatory designation.** Instead of requiring certain species to be designated as endangered or threatened if populations fall below scientifically determined thresholds, species designation is only optional under the Act, and subject to the political will of Cabinet.[74]
- **No mandatory protection.** Once a species is designated, the Act does not prescribe a timeframe within which protective measures, such as a recovery plan, must be in place. This means that if government priorities shift elsewhere, endangered species may be protected on paper, but remain under siege in the wild.
- **Wildlife management areas provide minimal protection.** The Act does not prescribe any prohibited or restricted uses or industrial activities within WMAs. The Act provides no mandatory protections within WMAs; the only requirement is that land users acquire the written consent of the regional manager of MoE.[75] Unlike protected areas, industrial activity such as forestry, mining, or waterpower projects are typically permitted within WMAs.[76] Only one WMA has been designated since 2001.[77]

Park Act

The *Park Act*[78] prohibits a variety of commercial and industrial activities within park boundaries that are incompatible with the recreational or other values of provincial parks. However, ROR projects have been exempted from key protections otherwise applicable under the Act.

Concerns about the *Park Act*:

- **ROR projects are allowed in some parks.** Park-use permits may be issued to allow "local run-of-the river projects" within Conservancies (a type of park) for communities that "do not otherwise have access to hydro electric power."[79]
- **Park waterways are not protected**. The Act does not prohibit or require mitigation of the environmental impacts of ROR projects built outside of park boundaries on waterways that later run through parks.
- **Park borders can be changed**. The government has unlimited authority to change the

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bearing'.

[74] Under section 6, the designation of endangered species is optional, even if it is clear that "a species of wildlife is threatened with imminent extinction throughout all or a significant portion of its range in British Columbia because of the action of humans".

[75] *Wildlife Act, supra* note 73, s. 4(4). The regional manager may decide on a case by case basis what the permitted, restricted, or prohibited uses are in a WMA by order. See Ministry of Environment website, "Wildlife Management Areas" http://env.gov.bc.ca/bcparks/explore/wma/ .

[76] Furthermore, the designation of a WMA does not affect the pre-existing rights of land users within that area. *Wildlife Act, ibid.,* s. 4(3).

[77] Ministry of Environment website, "Wildlife Management Areas, Alphabetically Listed" http://env.gov.bc.ca/bcparks/explore/wma/alpha_listing.html#u.

[78] *Park Act*, R.S.B.C. 1996, c. 344.

[79] *Ibid.*, s. 9(10) and (11)

boundaries of parks, other than "Class A" parks.[80] For example, when a ROR project was proposed requiring transmission lines through Pinecone Burke Provincial Park, the government simply invited the proponent to apply for a "park boundary adjustment" (which was later denied after huge public protest).[81]

- **Roads and transmission lines can go through parks.** Private construction in parks is prohibited without a permit,[82] but in Class B parks, a permit can be issued as long as, in the Minister's opinion, to do so is "not detrimental to the recreational values of the park concerned."[83] Construction permits can be issued in Class C parks (conservancies) with no restrictions.[84]

Heritage Conservation Act

The *Heritage Conservation Act*[85] seeks to encourage and facilitate the protection and conservation of heritage property in British Columbia.

Concerns about the *Heritage Conservation Act:*

- **Any environmental protection offered by the Act is incidental.** The Act's protective provisions are only triggered is if the proposed project would damage a designated provincial heritage site or an object of archaeological value. There are only 51 designated heritage sites, with a combined area of less than four kms^2, so the Act seldom applies to ROR projects.[86] Moreover, the Act allows the Minister to issue permits authorizing damage, destruction, or alteration of heritage sites and objects.[87]

Water Protection Act

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[80] *Ibid.*, s. 7. Per s. 5(3), Class A parks are the parks named in Schedules C and D of the *Protected Areas of British Columbia Act*, S.B.C. 2000, c. 17. For the BC park boundary adjustment policy, see the BC Parks website: http://env.gov.bc.ca/bcparks/planning/bound_adj_policy.html.

[81] See the "Draft Terms of Reference for the Upper Pitt River Water Power Project, Application for an Environmental Assessment Certificate", at page 69, which sets out the plan to seek a park boundary adjustment, online: http://a100.gov.bc.ca/appsdata/epic/documents/p291/d25465/1203704618323_ab877e2e9ab1433eb461a38c7aa5c447.pdf . The public opposition to the project is documented in news articles such as: "Pitt project was bungled from the beginning," the Province, p. A06, 27-Mar-2008; and, Scott Simpson, "B.C. government rejects Pitt power project" *Vancouver Sun* (March 26, 2008).

[82] *Park Act*, *supra* note 79, s. 13.

[83] *Ibid, s*s. 8(3) and (4). Park-use permits in Class A parks, by contrast, may only be granted if *necessary* to preserve the recreational values of the park: ss. 8(1) and (2).

[84] *Ibid.* In regards to conservancies, the Minister actually has explicit power to issue a permit authorizing road construction in a conservancy listed in Schedule F if the road is to provide access to natural resources lying beyond the conservancy (*Ibid*, at s.20.1). More stringent rules apply to Class A and C parks, for which a permit authorizing an interest in land or exploitation of resources must not be issued unless, in the opinion of the minister, to do so is "necessary to preserve or maintain the recreational values of the park involved" (*Ibid*, at ss. 8-9).

[85] *Heritage Conservation Act*, R.S.B.C. 1996, c. 187.

[86] Susan Green, Heritage Register Officer, BC Ministry of Tourism, Culture and the Arts, Personal Communication, 22 February 2010.

[87] *Heritage Conservation Act*, *supra* note 86, s. 12(2)(a).

Although the purpose section of the *Water Protection Act*[88] states that the Act is meant to "foster sustainable use of British Columbia's water resources in continuation of the objectives of conserving and protecting the environment," the legislation deals solely with transfer or diversion of water between the province's nine major watersheds and the export of water out of the province.[89]

Concerns about the *Water Protection Act:*

- **Most ROR projects are not subject to the Act.** Unless a proponent needs to remove or divert a large quantity of water from one of the nine major B.C. watersheds defined in the Act to another such watershed, the *Water Protection Act* does not apply.[90]

Transportation Act

The *Transportation Act*[91] was enacted in 2004 and replaced the former *Highway Act*[92], which dealt with the establishment, maintenance, alteration and regulation of public highways in BC.

Concerns about the *Transportation Act:*

- **Permits deal with public safety, not environmental protection.** If a ROR project needs to construct water pipelines or power lines within a right-of-way of a provincial road or highway, it must obtain an approval under section 62 of the *Transportation Act* in the form of a utility permit. The policies guiding these permit decisions exhibit a presumption in favour of accommodating utilities and focus on the protection of public safety on provincial highways.[93] Environmental concerns do not appear to factor largely or at all into these approvals.[94]

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[88] *Water Protection Act*, R.S.B.C. 1996, c. 484.

[89] "Water Protection Act Information", Ministry of Environment: Water Stewardship Division, online: http://www.env.gov.bc.ca/wsd/water_rights/water_act_info/index.html.

[90] Specifically, the Act only applies to projects diverting or extracting "10 cubic metres per second of water or more", or about "190,000,000 gallons of water a day". Proposed projects such as a major diversion from the North Thompson River into the Columbia River are prohibited under this Act. According to the Ministry of Environment website, smaller scale projects and those allowing major water transfers within a watershed are not subject to the Act, and "[i]t is the intention that both of these categories be covered by the *Environmental Assessment Act*", "Water Protection Act Information", BC Ministry of Environment, Water Stewardship Division, online: http://www.env.gov.bc.ca/wsd/water_rights/water_act_info/index.html). However, many of these smaller waterpower projects will never undergo a provincial environmental assessment due to the high thresholds required under the Regulations of the EAA (discussed above).

[91] *Transportation Act*, *supra* note 5.

[92] *Highway Act*, R.S.B.C. 1996, c. 181.

[93] See Province of British Columbia, Ministry of Transportation and Highways, Highway Planning Branch, "Utilities Manual", 1995, online: http://www.th.gov.bc.ca/permits/linked%20documents/working.pdf at p. 2.1-1.

[94] The purpose of a utility permit is to provide protection:

- to highway systems and structures against damage by utilities
- for highway users against hazards associated with utilities
- by providing an indemnity for the Ministry against liability claims
- for future use of the highway right-of-way

"Approval Process: Ministry Decision", BC Ministry of Transportation, online:

Significant Projects Streamlining Act

The *Significant Projects Streamlining Act*[95] came into force in 2003 and empowers the government to designate a project[96] as a "provincially significant project".[97] This designation triggers an expedited approval process authorizing government to remove[98] any constraints that "may impede or otherwise interfere with the completion or operations of the project".[99] The BC environmental assessment is the only regulatory process whose constraints on project development are not subject to "streamlining" or "replacement" under the Act.[100]

Concerns about the *Significant Projects Streamlining Act*:

- **The Act allows proponents and government to avoid existing legislative requirements and environmental protection measures.** This Act provides government the authority to circumvent most environmental checks on ROR projects should the government so desire. It allows for political interference and creates concerns about the reliability of the environmental protections provided by existing laws. Circumventing project approvals also deprives the public of opportunities for input.[101]

FEDERAL LEGISLATION

Canadian Environmental Assessment Act

The *Canadian Environmental Assessment Act*[102] ("CEAA") is designed to ensure that the environmental effects of major projects are reviewed before federal authorities take action in connection with them. An EA only occurs under the CEAA if there is a legal "trigger". A responsible authority (any of 35 federal departments) is required to undertake an EA if the authority:

- Proposes or undertakes a project;
- Grants money or any other form of financial assistance to a project;
- Grants an interest in the land to enable a project to be carried out; or
- Exercises a regulatory duty in relation to a project by issuing a permit or license that is included in the *Law List Regulations*,[103]

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http://www.th.gov.bc.ca/permits/Ministry%20Decision.asp.

95 *Significant Projects Streamlining Act*, S.B.C. 2003, c. 100

96 Section 1 of the Act provides the following definition of a project: **"**"project" includes the planning, development, construction, operation, modification or dismantling of a work, thing or activity."

97 *Significant Projects Streamlining Act, supra* note 96, s. 3(1).

98 The Act uses the word "replace" instead of "remove", but despite the euphemism, the effect of these provisions is the same.

99 *Significant Projects Streamlining Act, supra* note 96, ss.1, 3(2).

100 *Ibid.,* s. 11(2)(b).

101 The provisions of this Act have not yet been invoked in British Columbia.

102 *Canadian Environmental Assessment Act*, S.C. 1992, c. 37.

103 *Law List Regulations*, SOR/94-636.

in relation to a "project" as defined in section 2 of the Act.[104]

Concerns about the *Canadian Environmental Assessment Act:*

- **Most ROR projects that undergo federal EA are only subject to a screening.** Approximately 99 percent of all federal EAs are conducted as screenings.[105] A screening is the least rigorous level of assessment under CEAA (the next levels are a comprehensive study and panel review). Public participation and follow-up are at the discretion of the responsible authority.[106] An independent review of the federal EA process recently found that screenings were "weak," often consisting of checklists or generic statements, and providing "limited or no analysis or explanation of how environmental effects were rated."[107]
- **Federal EAs have also been widely criticized as failing to adequately address cumulative effects.**[108]
- **The Federal Government has just announced revisions to federal environmental assessment rules which will weaken environmental protections.**[109]

Fisheries Act

The *Fisheries Act*[110] governs the management of fisheries and the protection of fish habitat. It is administered by Fisheries and Oceans Canada ("DFO"). DFO authorizations under the Act are a common trigger for federal environmental assessments ("EAs") of ROR projects. Section 35(1) of the Act prohibits the harmful alteration, disruption or destruction ("HADD") of fish habitat. DFO may only issue a permit authorizing HADD if a federal EA of the project has been conducted. The proponent may be required to conduct mitigation, monitoring or contingency measures prior to receiving a HADD permit.

The *Fisheries Act* also prohibits depositing deleterious substances in water frequented by fish (subject to authorization under regulations).[111] It further requires that sufficient spillway be provided over an obstruction so that fish can travel over it, that owners of obstructions allow for the passage of migratory fish during construction, and that sufficient flows be provided below an

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104 The definition of "project" in section 2 includes "physical works" and "physical activities". "Physical activities" are prescribed for inclusion in section 59(b) of the *Inclusion List Regulations*, SOR/94-637.

105 "Status Report of the Commissioner of the Environment and Sustainable Development", November 2009, at sections 1.38-39, ("OAG Report") online: Office of the Auditor General, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_200911_e_33253.html.

106 CEAA, *supra* note 103, s. 18(3).

107 OAG Report, *supra* note 106.

108 *Ibid.,* at s. 1.33.

109 See *Globe and Mail*, March 31, 2010, "Ottawa revises rules of environmental review regime" at http://www.theglobeandmail.com/news/politics/ottawa-revises-rules-of-environmental-review-regime/article1518844/?service=email.

110 *Fisheries Act*, R.S.C. 1985, c. F-14.

111 *Ibid*., s. 36(3).

obstruction.[112]

Concerns about the *Fisheries Act*:

- **DFO has watered down the definition of HADD. Fewer projects now trigger the requirement for HADD permits or federal EAs.** In 1995, regulations were enacted making section 35(2) of the *Fisheries Act* a CEAA trigger. Prior to that time, DFO issued considerably more HADD permits under s. 35(2). Specifically, in 1990-91 there were over 12,000 authorizations issued. But in 1995-96 there were just 339, and in 2008-09 only 280. There is no evidence to suggest a dramatic decline in the number of projects that harmfully alter, disrupt, or destroy fish habitat. It stands to reason that DFO has radically altered its interpretation of what counts as a HADD of fish habitat such that fewer works are now considered to have harmful effects.[113]
- **Enforcement of deleterious substance prohibitions and other protective provisions is limited.** A recent report by the Auditor General of Canada identified numerous enforcement problems under the Act, including the inconsistent review of project proposals; and poor monitoring of mitigation, habitat loss, and compensation measures by approved projects. The report concluded that DFO could not demonstrate that it was adequately protecting fish habitat, as required the Act. [114]

Species at Risk Act

The federal *Species at Risk Act*[115] ("SARA") sets out the following process for protecting at-risk species. Following assessment by an independent scientific body, species are listed on Schedule 1 to the Act as endangered, extirpated or threatened. The Minister must then prepare a Recovery Strategy and an Action Plan that identify critical habitat to the extent possible. Once identified, critical habitat on federal land or for aquatic species or migratory birds must be protected within 180 days. If the species is on private, provincial or territorial land, the Minister may choose to recommend an order from the Governor in Council protecting critical habitat.

Concerns about the *Species at Risk Act:*

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[112] "…of such quantity of water, at all times, as will, in the opinion of the Minister, be sufficient for the safety of fish and for the flooding of the spawning grounds to such depth as will, in the opinion of the Minister, be necessary for the safety of the ova deposited thereon" *Ibid.*, s. 22.

[113] Arlene Kwasniak, "Slow on the Trigger, The Department of Fisheries and Oceans, the Fisheries Act and the Canadian Environmental Assessment Act" (2004) 27 Dalhousie L.J. 347 at 373. DFO's administrative policy confirms the above interpretation. Under DFO's Risk Management Framework, the issuance of a section 35(2) authorization is not recommended for projects placed in the "low risk" category (P. Duck, "An ENGO perspective of the Department of Fisheries and Oceans' Risk Management Framework" prepared for the Canadian Environmental Network, September 26, 2006. See also A. Kwasniak, F. Gertler & I. Corriveau, "ENGO Concerns and Policy Options Regarding the Administration and Delegation of Subsection 35 (2) of the Fisheries Act, Proposed Subsection 35 (3) and Consequences for Federal Environmental Assessment" (1996), prepared for the Fisheries Act Working Group, Canadian Environmental Network by the Quebec Environmental Law Centre.).

[114] See Scott Vaughan,"2009 Spring Report of the Commissioner of the Environment and Sustainable Development to the House of Commons", Office of the Auditor General of Canada (May 2009), online: http://www.oag-bvg.gc.ca/internet/English/parl_cesd_200905_e_32544.html.

[115] *Species at Risk Act*, S.C. 2002, c. 29.

- **Habitat protection is discretionary for most BC species.** Under SARA, habitat protection is mandatory only for aquatic species, migratory birds, and on federal land. Approximately 94% of the land in BC is provincial Crown land.[116] For species on provincial Crown or private land, SARA requires the Minister to recommend an order to protect a species and/or the habitat upon which it depends if he or she is of the opinion that a province is failing to effectively do so. To date however, despite the fact that BC has no species at risk legislation, no Minister has ever made such a recommendation, and the government has never passed such an order.[117]
- **Implementation of the protections under the Act has been slow.**[118] The Auditor General recently reported that the federal government had made "unsatisfactory progress" regarding the listing of species and development of recovery strategies under the Act. This report also concluded that the government was regularly failing to meet the statutory deadlines for recovery strategies.[119]
- **Recovery strategies fail to identify critical habitat.** The same report found that 92% of recovery strategies failed to identify critical habitat, the most important element of species conservation.[120] In BC there are at least 37 species for which officials have not obtained the requisite data to identify critical habitat, contrary to the duty under s. 41(1)(c) of the Act.[121]
- **The BC government has removed critical habitat from recovery strategies.** BC is required by agreement with Canada to prepare recovery strategies for at-risk species within the province, but documents obtained by the UVic Environmental Law Centre and Ecojustice Canada through FOI requests revealed a government policy to remove critical habitat from recovery strategies.[122]
- As a result of the above failures in implementation, many at-risk species remain without legal protection. Until such implementation occurs, waterpower projects in BC are likely to degrade habitat or otherwise impact at-risk species that do not yet enjoy the protections that would otherwise be available under SARA.

Navigable Waters Protection Act

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[116] BC Ministry of Agriculture and Lands, "Crown Land Factsheet" (no date), online: MAL http://www.agf.gov.bc.ca/clad/crownland_factsheet.pdf

[117] David Suzuki Foundation et al., *Canada's Species at Risk Act: Implementation at a Snail's Pace* (April 2009), online: http://www.naturecanada.ca/endangered_atrisk_saraRC2009.asp.

[118] *Ibid.*

[119] Status Report of the Commissioner of the Environment and Sustainable Development to the House of Commons, March 2008.

[120] *Ibid*.

[121] Two recent judicial review applications have found the responsible Minister in breach of the Act for failing to identify critical habitat in recovery strategies for at-risk species: *Environmental Defence Canada v. Canada (Minister of Fisheries and Oceans)*, [2009] F.C.J. No. 1052 (T.D.); *Alberta Wilderness Assn. v. Canada (Minister of Environment)*, [2009] F.C.J. No. 876 (T.D.).

[122] In fact, although there are 49 species for which government officials are aware that it is scientifically possible to identify critical habitat, such habitat is only legally identified for 6 of these species. "ELC Requests Investigation into BC's Refusal to Protect Endangered Species Habitat", Environmental Law Centre, online: http://www.elc.uvic.ca/press/endangered_species_request.html.

The *Navigable Waters Protection Act*[123] ("NWPA") is designed to protect the public right of navigation. It ensures that works constructed in navigable waterways are reviewed and regulated so as to minimize the overall impact upon navigation.

Concerns about the *Navigable Waters Protection Act:*

- **Effects on fish habitat and other environmental impacts are not within the purview of the Act**, and therefore are not considered during any authorization process for ROR projects. It is misleading to point to the NWPA as a means for environmental protection or regulation.

CONCLUSION

The BC government has made determined efforts to streamline environmental regulation in recent years. There remain a substantial number of statutes, regulations, and associated licences, permits, and other authorizations applicable to the environmental footprint of ROR projects. But this review suggests that there is little correlation between the number of applicable laws or approvals and the effectiveness of environmental protection. Many of these provisions are either rarely applicable, rendered ineffective by internal limitations, or of only a peripheral relevance to the assessment of environmental impacts.

The lack of clear, legislated standards to govern land tenure and water licence applications under the *Land Act* and *Water Act* leaves broad discretion to government officials. The majority of applicable regulatory procedures lack adequate public access to information and local government oversight. Appeal provisions are narrow in scope, unclear, and impractical. These features make existing regulatory procedures appear secretive and do not foster adequate public accountability. Amendments to the *Utilities Commission Act* require approvals to consider important environmental factors such as greenhouse gas reduction and the promotion of clean energy, but not potential impacts to wildlife habitat or water quality. This has created an unbalanced basis for decisions under that Act. In addition, key regulatory thresholds have been lowered or re-interpreted resulting in fewer ROR projects undergoing provincial and federal environmental assessments. Finally, there is evidence to suggest that monitoring and enforcement measures are underfunded, unimplemented, or ineffective due to the issuing of only nominal deterrents. These deficiencies, and the others discussed in this report, illustrate that BC's current regulatory framework fails to provide adequate environmental protection in the context of ROR development.

GLOSSARY

CEAA	Canadian Environmental Assessment Act
CPCN	Certificate of Public Convenience and Necessity (Utilities Commission Act)
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EAA	Environmental Assessment Act

[123] *Navigable Waters Protection Act*, *supra* note 5.

EAB	Environmental Appeal Board
EIA	Environmental Impact Assessment
EPA	Electricity Purchase Agreements (Utilities Commission Act)
FOI	Freedom of Information
FOIPPA	Freedom of Information and Protection of Privacy Act
FRPA	Forest and Range Practices Act
GWMs	General Wildlife Measures (Forest and Range Practices Act)
HADD	harmful alteration, disruption or destruction (of fish habitat) (Fisheries Act)
ILMB	Integrated Land Management Bureau
IPP	Independent Power Project
MOFR	Ministry of Forests and Range
NWPA	Navigable Waters Protection Act
OLTC	Occupants Licence to Cut
ROR	run-of-river (hydroelectricity projects)
SARA	Species at Risk Act
WMA	Wildlife Management Area (Wildlife Act)
WSD	Water Stewardship Division (Ministry of Environment)

Tamed Rivers VERSION 3

CONFIDENTIAL DRAFT
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Hydropower in British Columbia: a guide to impacts and opportunities

Watershed Watch Salmon Society

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The Taming of BC's Rivers

Provincial energy policies have made British Columbia a global testing ground for "run-of-river" hydroelectricity. Yet these kinds of hydropower projects (more correctly described as river diversions) are controversial, as are BC's policies promoting their development.

Public concerns over provincial hydro policy were elevated in 2002 when the provincial government directed BC Hydro to purchase new electricity from private developers[1]. In the following decade, the provincial water licensing branch has received over 800 water license applications for hydropower development on BC streams and rivers. BC Hydro has received over one hundred bids in response to 'clean power calls', with the majority being for river diversion hydropower. Unfortunately, the placement of river diversions is not tied to any land use planning. BC Hydro conducts "strategic energy planning" in deciding which bids to reward with Electricity Purchase Agreements, but that process is not transparent and does not take environmental factors into consideration. There is no planning to designate areas best suited for energy development, or best preserved for other values. The lack of planning and the nature of the private sector-led development, combined with deficiencies in provincial and federal environmental assessment processes, have led to problems with information sharing, public involvement, and the capacity to monitor and manage environmental impacts.

BC's energy policy has thus created unintended consequences, with many valleys proposed for extensive industrial developments, often from multiple developers. Wilderness and ecosystem values, including healthy fish and wildlife populations, are now under threat. From an energy generation standpoint, this scattershot approach does little to ensure that British Columbians are ending up with an optimal suite of projects.

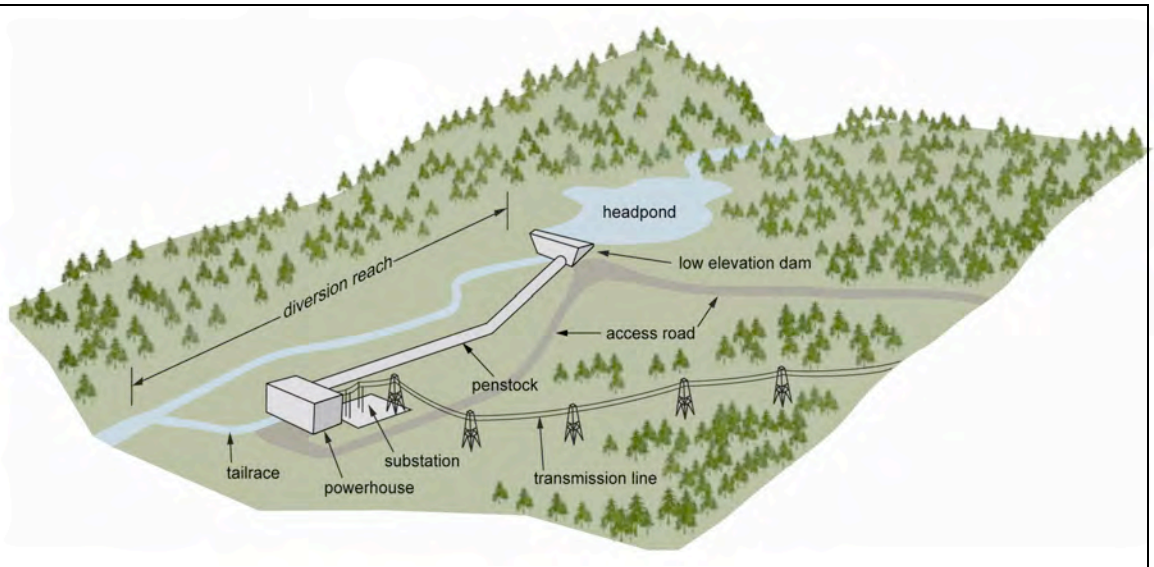
Not surprisingly, several proposed river diversion projects have met fierce opposition in the past few years over concerns for fish, wildlife, tourism, and recreation in the affected watersheds. The Upper Pitt River, Glacier-Howser Creeks, Ashlu River, Bute Inlet, Sedan Creek, Kokish River, and the Klinaklini River, were (and still are) among the most contentious. Likewise, the provincial policies behind these projects have also suffered strong criticism. At the root of these criticisms are concerns over a lack of land-use planning, public participation in decision-making, insufficient environmental assessment, lax monitoring requirements, and concerns over the long-term financial impacts to BC Hydro and BC's ratepayers from privatizing electricity generation.

Watershed Watch offers **Tamed Rivers** as a tool to better understand the impacts of river diversions on fish, wildlife and their habitats. **Tamed Rivers** also emphasizes the urgent need for a better framework for how renewable energy is developed in BC, and how this might be achieved. This report deals primarily with environmental impacts. All forms of electricity generation have environmental impacts, and even strong supporters of renewable energy development in BC agree that our goal should be to generate the most

electricity of the highest quality (reliability) for the least amount of environmental damage. This balancing act requires careful consideration of the ecological limits to development and of the natural values that we wish to sustain into the future. It also requires attention to energy conservation, so that we develop the minimum number of new projects to sustain our needs. Watershed Watch developed **Tamed Rivers** to help BC develop the appropriate types and locations of hydropower as part of BC's overall energy portfolio.

River diversions in BC

'Run-of-river' hydropower is the terminology used in BC. However, the term run-of-river can be misleading by fostering the impression of a small facility where river current is used to power a water wheel. Run-of-river simply means that water is not stored behind a dam for more than 48 hours; even very large facilities such as BC Hydro's Site C are technically run-of-river. Watershed Watch prefers to use the term 'river diversion' (as used by the World Commission on Dams)[2] to more accurately convey what is entailed. This term also includes those projects that augment the water available for electricity generation by storing extra water in an alpine lake or a small reservoir. A defining feature of a river diversion is the piping of water out of the river and into turbines at a downstream location. Just how this is done depends on the local site, but it almost always entails a long stretch of river having dramatically reduced flow.



Run-of-river hydropower is the predominant kind of renewable energy being developed by private developers in BC, as it is usually less expensive to produce than wind or solar power. This diagram shows the typical components of a run-of-river (also known as a river diversion) project.

River diversions are often perceived as environmentally friendly, since they can be done at a much smaller scale than typical hydropower dams, and do not require a large

reservoir. In fact, depending on site-specific factors, short river diversions can be the very best and greenest choice. But according to a recent paper,[3] the perception that 'small hydro' (another popular term for river diversion power) is clean and green is driving a surge of interest in its development all over the world – and creating a suite of unintended consequences when networks of these projects are developed. When viewed as impact per mega-watt of power generated, there is no reason to believe that extensive development of small hydro causes less environmental impact than large, centralized hydropower dams[4]. Indeed this has become clear in BC in recent years with the likely impacts of clustered river diversions approved and proposed along the south coast.

Hydroelectricity in BC

Approximately 76% of the power used in BC is from locally-produced hydroelectricity, and of this, about 90% is from BC Hydro's large dams.[5] As of December 2011, 51 private power projects were also generating hydroelectricity, which accounts for about 11% of BC's total electricity supply.[6] River diversion projects account for about half of this amount, with the rest supplied by Rio Tinto Alcan's massive Kemano project on the Nechako River, the Columbia Basin Trust and the Waneta Dam near Trail.

At least 35 additional private hydro projects have received electricity purchase agreements from BC Hydro. These projects are still in development or under construction with the majority being river diversion projects. While some of these may not go ahead, these projects would represent about 8% of BC's current supply. By contrast, the proposed Site C BC Hydro dam represents about 2% of BC's current supply.

Large dams will likely remain the most important part of BC Hydro's energy portfolio, as many hundreds of new river diversions would be required to replace them. Wind, solar or tidal power may become more important in the future, but at this time these options are less available and more expensive than hydroelectricity.

A full cost accounting of greenhouse gases

Climate change is one of the most pressing issues of our time. It is exceptionally important to use more renewable energy, in order to reduce and avoid dangerous changes to our planetary life support systems.

Project proponents state that river diversion power produces zero greenhouse gas emissions over a very long project life. While it's true that hydroelectricity is emissions-free, this doesn't count the fossil fuels used to construct and maintain the facilities, and to eventually decommission them. In fact, greenhouse gases emitted in these ways can account for over 90% of the total emissions.[7]

Actual greenhouse gas emissions from river diversion projects[8] [9] [10] vary, and can be greater than emissions from Canada's large hydropower dams.[11] Life-cycle emissions depend on local factors, so some projects can have greater impacts than others.[12] For a mid-sized diversion such as that on Ashlu Creek, the life cycle emissions would average out to over 2,500 tonnes of carbon annually (roughly equal to the emissions of 500 cars), a far cry from zero.[13] Using the same calculations, the currently operating river diversion projects in BC will have lifetime emissions that would equal those of almost 350,000 cars on the road for one year.

Notably, the smaller the project, the greater the emissions per unit of energy produced, as the ratio of construction materials and transportation increases.[14] Project construction and construction materials account for about 60-70% of greenhouse gas emissions. Part of this is due to the use of concrete for dams, intakes and powerhouses, as concrete manufacturing is the third largest source of greenhouse gases worldwide.[15]

Carbon dioxide is permanently released when vegetation is cleared for roads and transmission lines and for the project site.[16] When long roads are involved this can be especially significant, as heavy equipment is required, many trees are removed, and there is ongoing fossil fuel use for road maintenance and increased recreation. The kinds of forested ecosystems where most river diversion projects are proposed store 300 – 500 tonnes of carbon per hectare (about 100 tonnes of which is in vegetation),[17] and are net carbon sinks. This means that they are capturing additional carbon every year. In fact, every hectare of forest captures about 3 tonnes per year, equal to about 60% of the emissions of the average car.[18] When these forests are removed for roads and other project infrastructure, this contributes to climate change.

Methane emissions are a serious issue usually associated with the flooding of reservoirs for large hydro dams.[19] Methane is a potent greenhouse gas, with effects far worse than those of carbon dioxide. River diversion projects can also produce significant methane, depending on site specific conditions.[20]

Full cost accounting should be applied to run of the river projects so that greenhouse gas implications are more thoroughly understood.

Aquatic impacts of river diversion

Tamed Rivers focuses on river diversion projects, also known as 'run-of-river' and 'small hydro', which are the predominant form of new hydropower development in British Columbia. Some projects also propose storing water in alpine lakes or small reservoirs, in addition to diverting rivers.

For river diversion projects in BC, water licenses specify how much water can be diverted, as well as how much must be left instream. The amount that must be left instream (called the *instream flow requirement*) is very small compared to natural flows. Most of the year, the instream flow requirement is all that will be left in the river between the diversion and the point at which the flow is returned. Instream flows will increase beyond this amount only during times of seasonally elevated run-off, when available water exceeds the amount that can be diverted.

The aquatic impacts of river diversion projects are caused by lowered instream flows, by changes to flow downstream of the diversion (ramping rates), and by the footprint of the development itself. Temperature changes below the diversion reach can also be a problem.

Most of the time the river diversion is built just upstream of salmon and steelhead habitat, though resident fish populations are present in most sites. Resident fish in BC include rainbow trout, cutthroat trout, and bull trout (a species of charr), among others.

In a nutshell:

River diversion projects affect the aquatic environment by dramatically reducing flows through the 'diversion reach' – a stretch of river that can be five or more kilometers long. Other impacts result from the footprint of the project itself: the streamside roads and power lines, the powerhouse, and the diversion dam. Day-to-day operations are also very important, and rapid changes to flows within and below the diversion reach are serious problems that can be difficult to address.

Because everything is connected, changes in flows affect not only the quantity and quality of aquatic habitat, but also streamside vegetation, food web components (such as insects), and the shape of the channel itself. Even temperature can change, both in the diversion reach and downstream.

The diversion reach and the diversion dam can be barriers to fish migration. In most cases these will be situated above the range of migrating salmon, but will still divide resident fish populations in two.

The practice of diverting rivers for hydroelectricity is relatively new, and the impacts are still under study. In some cases these developments can provide truly low-impact renewable energy, but they can also have extensive and profound negative effects. Care must be taken to ensure that river diversion projects are done well, and in appropriate locations. This includes strategic planning for renewable energy in BC, to minimize the impacts per mega-watt-hour of electricity generated.

Reduced instream flows

The amount of water that must be left instream determines whether a river diversion project will be financially viable. When more water is diverted more electricity can be generated, and the project becomes more profitable. In order to be profitable, the majority of available flows must usually be diverted.[21] This creates a strong incentive to leave the lowest possible amount for instream needs.

The provincial government has a procedure for determining instream flow amounts for fishless and for fish-bearing streams,[22] but this procedure results in thresholds for fish-bearing streams that are often deemed too high for run-of-river projects to be financially viable.[23] These guidelines were developed to be used as a 'coarse filter' for reviewing water license applications in BC, and project proponents supplement these guidelines with their own studies to propose minimum instream flows to protect aquatic life. This is a difficult task to do well,[24] particularly as there are little to no existing hydrology data for most locations. While various methods can be used to understand and model instream flows,[25] [26] [27] [28] [29] these methods necessarily make some broad assumptions (such as the application of a single guideline to diverse geographical regions, or the use of a standard percentage of flow). Even the most detailed and onerous of methods have limitations for assessing instream flow needs, and in practical terms are unlikely to describe flow patterns at the smaller scales to which fish often respond.[30]

Until recently, the effects of river diversions on fish populations were not well studied in BC. Recognizing this, the Province of BC now requires river diversion proponents to do extensive monitoring of fish and fish habitat. Unfortunately, definitive results are not yet available, leaving little real-world data to evaluate the dozens of river diversion proposals pending in BC. If unacceptable impacts to fish and fish habitat or other values are discovered, it is possible to amend the water license to increase the instream flow requirement. In reality, making an adjustment to a water license would require significant proof of harm based on solid monitoring results, since increases to instream flows could result in substantial financial losses. Several years of monitoring will likely be required to better understand the environmental effects of river diversion in BC.

A warning from Norway

So far there are little conclusive monitoring data about the effects of river diversions in BC, simply because this is a new technology here. However, results are in from Norway, where steep terrain supports thousands of hydropower plants that supply 99% of

Norway's electricity.[31] River regulation is the single biggest cause of problems for salmon in Norway, resulting in both loss of stocks (19 extinctions, more than any other cause) and significant reductions in the productive capacity of salmon rivers.[32] Millions of dollars are being spent to try to mitigate the negative effects, and a solution under consideration is to take some river diversions out.[33] While Norwegian conditions are not identical those in BC (and include older plants which have operated with less stringent standards), we can still take warning from their experience.

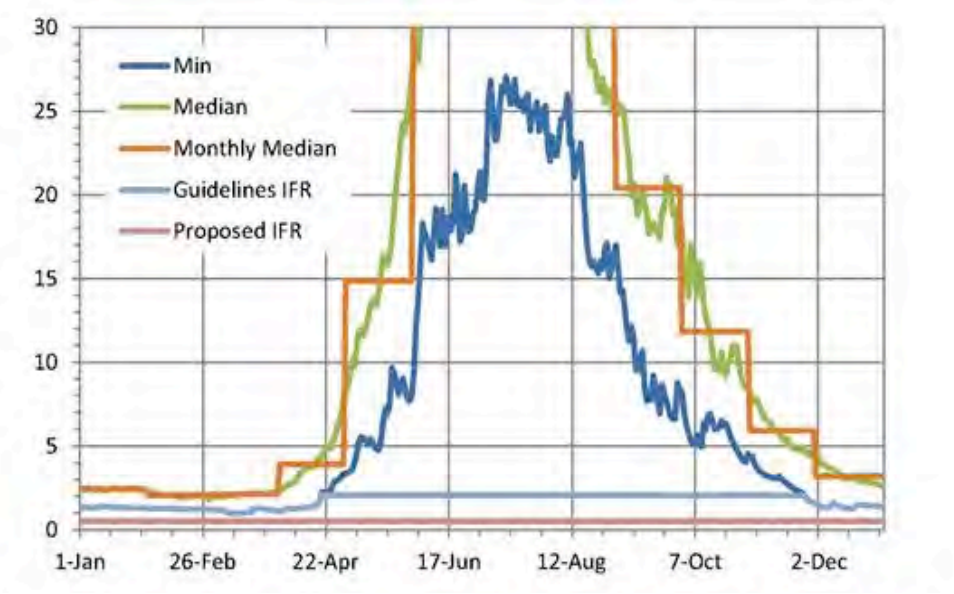
How much water is left instream?

The East-Toba Montrose project near Powell River consists of two linked river diversions. At the East Toba site, the flow that can be diverted is 30.7 cubic meters per second (m^3/s), and the instream flow release is 0.70 m^3/s. This means that up to 98% of the flow can be diverted, depending on flow conditions. The instream flow requirement is only exceeded approximately 20% of the time, when excess flow is allowed to spill down the diversion reach. The numbers are similar for the Montrose site, where the flow that can be diverted is 22.8 m^3/s and the instream flow release is 0.52 m^3/s. Another way to understand the remaining quantity of water in the diversion reach is to determine how often flows would naturally drop to this level. For the East Toba site, pre-diversion flows (based on limited data) would be at this level only about seven days per year. For the Montrose site it would be even less – under natural conditions, flows would equal the instream flow requirement for perhaps three to four days per year.[34]

Instream flow releases and diversion flows for existing and proposed river diversions

Planned Project	Stream Name	Capacity (MW)	Diversion Flow (m3/s)	IFR (m3/s)	% Water Diverted (maximum)
East Toba-Montrose	Montrose	73	20.26	0.25	**99**
	East Toba	123	28.89	0.71	**98**
Upper Toba	Dagleish Creek	30	5.7	0.18	**97**
	Jimme Creek	55	16.4	0.64	**96**
	Upper Toba	45	20.8	1.01	**95**
Bute Inlet	Scar Creek	88	28.6	1.24 – 3.1	**89 - 96**
	Coola Creek	23	13.4	0.58 – 1.45	**89 - 96**
	Whitemantle Creek	83	22.3	0.78 – 1.21	**95 - 97**
	Brew Creek	103	37.8	1.64 – 3.69	**90 - 96**
	Jewakwa River	79	39.7	1.38 – 2.16	**95 - 97**
	Heakamie River	52	34.8	1.21 – 1.89	**95 - 97**
	Gargoyle Creek	40	6.9	0.3 - 0.75	**89 - 96**
	Bear River	46	58	2.52 – 5.67	**90 - 96**
	Elliot Creek	70	14.7	0.51 – 1.12	**92 - 97**
	Icewall Creek	71	22.1	0.77 – 1.44	**93 - 97**

	Raleigh Creek	51	17.5	0.61 – 1.33	**92 - 97**
	Southgate River 1	143	39.2	1.20	**97**
	Southgate River 2	28	9.4	0.25	**97**
	Alaire Creek	67	22.2	0.58	**97**
	North Orford River	18	10.2	0.42 - 0.91	**91 - 96**
	East Orford River	35	13.1	0.46 - 1	**92 - 97**
	Algard Creek	29	14.8	0.65 - 1.46	**90 - 96**
Upper Harrison	Tipella Creek	16.7	7.2	0.35	**95**
	Upper Fire Creek	5.9	1.74	0.10	**94**
	Lamont Creek	28	8.67	0.50	**94**
	Upper Stave River	33.5	43.8	2.60	**94**
	NW Stave River	18.1	31.5	1.30	**96**
Glacier-Howser	Glacier Creek	44.5	13	0.65	**95**
	Howser Creek	55	20	0.95	**95**
Kwoiek	Kwoiek Creek	50	13.5	0.55	**96**
Kokisk	Kokish River	45	23.33	3.00	**87**
Cascade Heritage	Kettle River	25	90	1.00	**99**
Iskut Cluster	Forrest Kerr	195	252.02	5.00	**98**
	McLymont Creek	66	30.7	0.50	**98**
Pingston	Pingston Creek	25	5.4	0.30	**94**
Nascall	Upper Nascall River	40	65	2.24	**97**
	Lower Nascall River	31	75	3.14	**96**
Europa	Europa Creek	102	18.08	0.18	**99**
Tyson	Tyson Creek	9.3	1.3	0.07	**95**
Ashlu	Ashlu Creek	49.9	29.3	2.42	**92**



The annual hydrograph for McLymont Creek, showing the average monthly flows, minimum flows, and the instream flow release (IFR) that government guidelines[35] recommend. The proposed IFR is even lower than recommended guidelines, and vastly smaller than natural flows.

Environmental impacts of big hydropower dams

Large hydro dams have well recognized environmental impacts, which have become clear since their widespread construction began in the 1950's [36]. These include:[37]

- Flooding of high value habitats such as low elevation forests, wetlands, and salmon streams, and the elimination or displacement of the wildlife populations that depend on them;
- Release of methane (an extremely potent greenhouse gas) and carbon dioxide due to flooding of vegetated areas – in some cases making the energy from large dams little better than fossil fuels;[38]
- Changes to nutrient levels (e.g. eutrophication) due to leaching from flooded soils and sequestration of nutrients associated with suspended sediments;
- Increased siltation (behind dams), impacting bottom-dwelling organisms, and loss of suspended sediments downstream of dams, reducing the natural deposition of fine sediments – an essential component of healthy floodplain ecosystems;
- Increased concentrations of mercury (a potent neurotoxin) in high trophic-level fish and birds, due to bio-accumulation, as naturally occurring mercury is released from decomposing organic matter;
- Displacement of human settlements and loss of traditional land uses; and,
- Barriers to fish migration upstream and downstream, often leading to the fragmentation or even the extinction of unique fish populations.

Other common impacts[39] of large dams are similar to those of river diversions, and can be even more serious:

- Dramatic changes to downstream flow patterns. This includes reductions in habitat quality and quantity due to reduced flow. It also includes the loss of the natural processes of erosion and sedimentation that occur in healthy floodplains as a result of flooding. Loss of flooding means a reduction in channel migration, and a loss of the shifting habitat mosaic that supports aquatic and terrestrial biodiversity.[40] This includes the dewatering of smaller side channels due to a drop in the water table.[41] The loss of natural floods also leads to altered streamside (riparian) vegetation, with negative impacts to the riparian food web, including the wildlife and plants adapted to live there. Some of these impacts can be more severe for lower gradient channels with established floodplains[42]– i.e., the type of channels most common below large dams.
- Problems with rapid changes in flow (ramping rates), leading to fish stranding;
- Entrainment of fish and other aquatic life in power turbines;
- Aquatic ecosystem impacts caused by changes to temperature, sediment and large woody debris patterns;
- Deforestation and other direct habitat loss caused by the project's terrestrial footprint (i.e., power lines, roads, and dams), with associated CO_2 emissions and potential harm to sensitive species;
- Fragmentation of important habitats due to the linear infrastructure of power lines and dams – a particular concern for river diversion projects in remote areas; and,
- Construction impacts such as spills, erosion, siltation, noise pollution, carbon dioxide emissions and human disturbance of wildlife.

While flows downstream of large dams are usually less "natural" than flows below river diversion projects, large dams can provide precise flow releases to support aquatic life downstream, including augmented flows during low flow times of year.

River diversion projects are sometimes seen as 'greener' than large hydro dams, because they put all the water back into the channel and don't have reservoirs. However when all the various impacts are examined, there is no reason to believe that river diversion projects are less harmful than big dams. [43] That said, comparisons between river diversions and large dams can be difficult to make, given that "run-of-river" power is intermittent while large dams can provide stable year round power. In fact, British Columbia's large dams provide an essential power-storage service for non-firm power from river diversion projects.

How does reduced flow affect streams?

In nature, healthy stream habitats and food webs are maintained by complex factors that include high flows during spring snowmelt or winter rains, the downstream movement of gravel and woody debris, and interactions between the stream and the surrounding vegetation. Everything is ecologically interconnected, and the full effect of dramatic flow reductions is impossible to quantify. In **Tamed Rivers** we describe some of the better known effects of reduced flow on stream ecosystems.

Less habitat, and changes to remaining habitat

Fish need water and river diversion projects dramatically reduce the amount of water in long stretches of river. Reducing the 'wetted width' of a stream will reduce the amount of fish habitat. It will also change the depth and velocity, key factors that determine the value of fish habitat as well as its suitability for other life forms. Sometimes, reduced flows may actually increase the habitat suitability for fish and other organisms (through for example increases in temperature that might lead to increased growth[44]), but this must be weighed against other consequences, such as the loss of "spray zones" associated with steep and turbulent stretches of river, *<<link or page reference to spray zones section>>* as well as other long-term changes to habitat quality.

The extent of the damage to BC's rivers is not well understood, because river diversion projects have become common only in recent years and little research has been completed.[45] In fact, the full impacts of river diversion on physical, chemical and biological conditions may take decades or centuries to become apparent.[46] [47] Some rivers will be more vulnerable than others, and the response of higher gradient stream channels to flow depletion varies considerably.[48]

The types of changes that occur in diverted rivers are well known, and Watershed Watch describes them below

How many river diversion projects are in fish-bearing waters?

For 42 existing and proposed river diversions that have public information on fish presence:

- 72% have confirmed or suspected fish presence
- 21% have unknown status with respect to fish presence
- 7% are confirmed to have no fish present

The species living at diversion sites are usually resident (non-sea-going) fish: rainbow trout, cutthroat trout, and/or bull trout. Salmon are present in the locations for one proposed and one approved diversion. Salmon are suspected to be present at four proposed diversion sites.

Changes to the river channel

River floodplain ecosystems can be described as "shifting habitat mosaics."[49] These mosaics of aquatic and riparian habitat will shift in time and space in response to naturally varying flows, including floods. Dams and diversions cause predictable harm to the mosaic, because of their distinctly un-natural flow regime. Reduced flows will immediately bring changes to river depths and velocities. Over time the structure of the channel itself will change and thus the shifting habitat mosaic becomes simplified with great loss of aquatic and riparian biodiversity.[50]

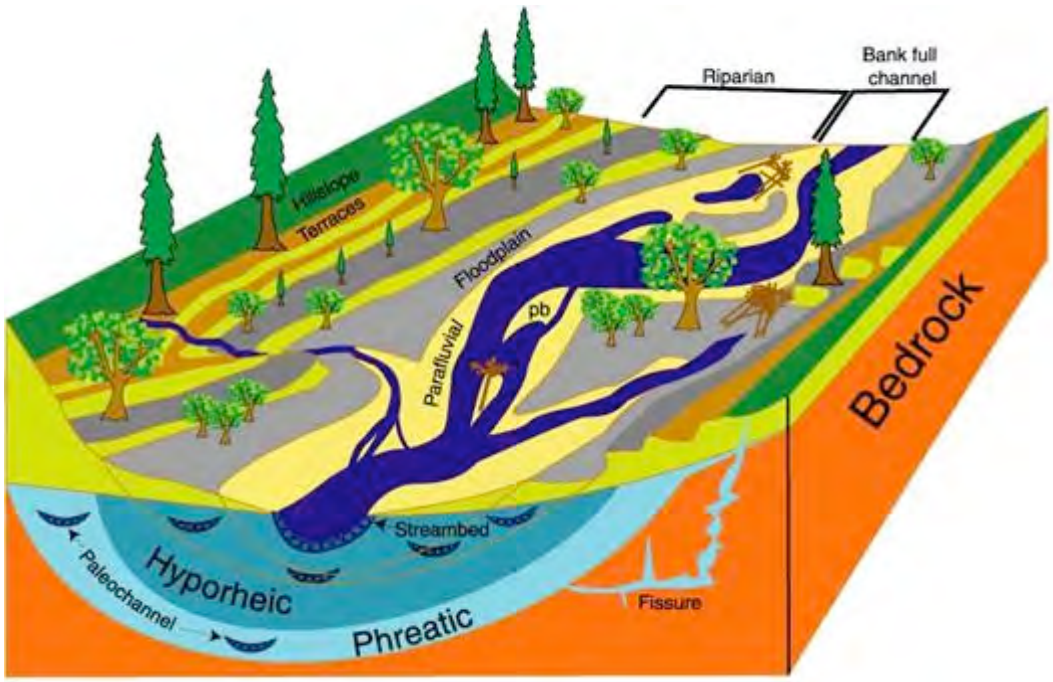
River channels below dams and diversions experience long-term changes in their habitat value, shape (and sometimes size) because of interconnected reasons, chiefly:

i) reduced high flows that eliminate the cut and fill processes that maintain natural channel networks,
ii) accumulation of fine sediments that fill in pool habitats and clog up gravels, and,
iii) an interrupted supply of channel forming elements, i.e., gravels and other sediments as well as woody debris.

In lower gradient channels, a *lack* of change in the channel's location on the floodplain is a notable result of flow regulation.[51] Generally speaking, low gradient channels (e.g. below gradients of 1.5%[52]) experience the most dramatic changes in response to dams or diversions. River diversion projects are by necessity in higher gradient stretches of river. Nonetheless, harm to the diversion reach is still unavoidable given the dramatic reductions in flow through the diversion reach.

Reduced high flows
Floods that happen only occasionally (e.g., every one to two years) are described as 'channel maintenance flows.'[53] In BC these flood flows are defined by their size relative to the average annual flow (>400% of mean annual discharge, occurring over a period of days[54]). These channel-maintaining floods define and maintain the channel banks, and move boulders, gravels and woody debris into new configurations. While this can cause some destruction, it is also a form of renewal. Floods provide a critically important ecological function in all rivers. In environments undisturbed by human impacts, river floodplains are dynamic environments that support a great amount of biodiversity.

Proponents of the majority of river diversion projects can only rely on reduced natural flows overtopping the dam to provide high flows for channel maintenance. In other words, there is no ability to actively manage high flows, since there is little storage in head ponds. Based on Watershed Watch's analysis of several existing and proposed projects, the frequency of channel maintenance flows are typically reduced to less than half of their natural frequency.[55] In addition, the magnitude of floods will be reduced by the amount of water flowing through the penstock. The floods that still occur may be enough to maintain the channel in its natural condition. However, there is insufficient information to confirm that this is the case.



In lower gradient rivers, the floodplain can be described as a 'shifting habitat mosaic'. The form and extent of the mosaic is changed below dams or diversions, due to a lack of channel-forming and channel-shifting flows. Without these flows there is a loss of lateral and vertical exchange of surface and groundwater, which is a primary source of biodiversity and productivity. [56]

Accumulation of fine sediments

When a major amount of water is removed, fine sediment (silt and sand) can build up in the channel. [57] [58] While healthy rivers and streams contain a mix of fine and coarse sediments, it's well known that fine sediment can clog the river-bed gravels that fish use for spawning, reducing the survival of overwintering eggs and embryos. [59] [60] [61] [62] [63] Benthic invertebrates (bottom-dwelling insects) that live in these gravels may also be adversely affected,[64] [65] or experience shifts in community structure. This can affect juvenile fish through removing their prey, [66] and means that fine sediments affect food webs even in streams without fish.

A recent study showed that channels downstream of diversion dams contain significantly more fine sediment and slow-flowing habitat than in similar upstream.[67] In nature, 'flushing flows' move this fine sediment downstream, and eventually out to a lake or the sea.[68] One way of describing flushing flows is by their size relative to the annual average flow – about 200% of mean annual discharge[69] – though 'flushing flows' are defined in different ways and are sometimes treated as interchangeable with 'channel maintenance flows'.[70] [71]

Conventional hydro projects often plan for the special release of flushing flows to clean out fine sediments. In the case of river diversion projects, flushing flows happen when the diversion dam is overtopped during seasonal high flows. However, the frequency of

flushing flows will be significantly reduced from natural conditions. Based on Watershed Watch's analysis of several proposed and existing projects, the frequency of flushing flows will be reduced up to 10-fold, and the magnitude of the flushing flow will also be reduced. [72] For BC's diverted rivers, there are no completed studies to indicate whether this reduced frequency might create problems with sediment accumulation between 'flushes.'

Interrupted supply of sediment and large woody debris.

The structural elements of streams – large woody debris and sediment – are partly delivered by upstream reaches.[73] Large woody debris (LWD) is simply the trees and branches that fall into the stream channel. Sediments are cobbles, gravels, and finer grained sands, silts, and clays that make up the stream bottom.

The importance of LWD for fish habitat is very well documented.[74] Channels that lack LWD tend to provide poor fish habitat. This is because LWD provides complexity in channels, stabilizes channels, maintains pools, and provides hiding cover for fish. LWD is usually lost as a result of streamside logging, and can also be in short supply because of a lack of delivery from upstream reaches. LWD is so important to stream structure that habitat restoration projects commonly involve placing logs in the stream, [75] as well as planting coniferous trees to assure long-term LWD supply. [76] In addition to providing stream structure, the habitat provided by large woody debris also supports invertebrate (insect) populations, which in turn are food for fish and other life forms.[77]

Sediment supply is a difficult issue below traditional hydro dams. Too much fine sediment accumulates because of slower moving waters, and at the same time, too little sediment of all sizes is available to maintain the channel form and provide quality spawning beds. This is due to sediment being trapped behind the dam.

River diversion projects will have fewer problems with trapped sediment than traditional hydro projects. This is because the low dam will be overtopped every year, allowing sediments to move downstream. Some diversion dams also incorporate the ability to flush the head pond of accumulated sediments, using sluice gates or deflatable rubber sections. Some head ponds are predicted to hold as much sediment as is moved during 5-50 year flood events[78], and could release all this sediment at once during manual flushing. Others do not have this feature, and will trap sediment on a permanent basis. Although not likely a problem during higher flow months, during low flow months the flow in diversion reaches may well be starved of sediment and could increase erosion, [79] [80] or cause other negative changes to channel shape or habitat quality.

Stockpiled LWD not transported by high flows will probably need to be manually moved over the dam, as is the plan for at least one river diversion project.[81] Questions remain about whether there are any negative effects related to the timing of sediment and LWD movements downstream. And because a substantial amount of the stream flow will still be diverted into the penstock – even at peak flows – it is unclear whether the reduced magnitude of the peak flows will be sufficient to move the LWD downstream.

Ongoing uncertainty of the impacts of flow reduction

Minimum instream flow recommendations are usually based on standardized calculations that are used to predict physical and biological impacts. However, such methodologies (such as the BC-modified Tennant method) may not fit the wide diversity of streams in BC.[82] [83] [84] Other more detailed methods, such as the Instream Flow Incremental Methodology (IFIM) and its component Physical Habitat Simulation (PHABSIM), require an immense amount of work, and are not broadly applicable across many streams. While these more intensive methods are useful in quantifying habitat for a given species or life stage, they are difficult to apply across the full ecological spectrum present in most aquatic environments.[85] To attempt to fully understand the effect of flow reduction on habitat quality and quantity, a great deal of work would need to be done at an extremely fine scale – something which is not usually feasible for streams with complex channel geometries.[86]Generally speaking, hydraulic modeling does not reveal flow patterns at the scales important to fish,[87] and as such can't provide the kind of biological understanding that would be desirable in order to understand the likely impacts of reduced flows.[88] Consequently, no matter what method is used to determine instream flow requirements, an accurate prediction of the changes to the quantity and quality of the remaining habitat is not likely, and may not be possible within the constraints of a development project.

A greater understanding of the impacts of flow reduction will come as more monitoring data are collected and analyzed. Unfortunately it will take a number of years before monitoring results are available to inform newly proposed projects.

Changes to water velocity and depths

Water velocity and depth are two key factors that determine the value of fish habitat. Reduced flows will affect both, and the degree of change will depend on the shape and size of the channel itself. Different fish species prefer different velocities and depths, so assessments must be based on which species are present. Hydrological modeling can predict depth and velocity changes at a coarse level by looking at the channel shape and at the normal flows throughout the year. Modeling will generally show that small streams will need to retain a greater proportion of their flow than larger streams, in order to retain the preferred velocities and depths for fish.[89]

Seasonal timing of flows

Fish and other organisms respond to seasonal cues for parts of their life cycles. For example, salmon migration and spawning are often triggered by fall rains. According to an analysis by Watershed Watch, many diversion reaches will experience a significant delay in the onset of seasonal high flows, and a consistent reduction in the magnitude of peak flows compared to natural conditions.[90]

It's difficult to predict the ecological effects of delaying and reducing high flows over the life of a power project. In some years, important flushing flows might not happen in time to clean spawning gravels in the diversion reach. Changes to flow timing could also affect the food web – for instance, changing the timing of fish fry emergence relative to the availability of their prey, with consequences to the health or size of the local fish population.

For river diversions in fish-bearing habitat, the provincial and federal governments typically require increased instream flows during certain times of the year in order to maintain critical fish habitats. For example, flows would be increased in spring and summer to maintain spawning and rearing habitat for trout, and increased flow would also be required to support fall spawning habitat for charr (bull trout). Less flow would be required over the winter months to support overwintering habitat. The effectiveness of these flows remains to be seen. Monitoring of fish populations and fish habitat is generally carried out by project proponents, based on requirements negotiated with the Province prior to receiving a water license. Conclusive monitoring results are not yet available.

Changes to temperature

Water temperature directly affects habitat quality as well as habitat quantity for fish and other aquatic organisms. Reductions to flow will affect temperature in both winter and summer. Reduced flow will allow the remaining water to heat up more in summer and may help fish grow faster and larger. In cold coastal streams this can increase the possibility of survival and shorten time to maturity. However, this can have other effects: in one study the benefits of warmer waters led to earlier migration to sea, which then resulted in reduced marine survival.[91] If summertime waters heat up too much as a result of reduced flows, fish can suffer stress or even death. Overly high temperatures are a common result of water extraction in BC's interior streams,[92] and may soon happen more often in cooler coastal streams as a result of BC's warming climate.[93]

In winter, reduced flow could increase the possibility of harmful ice formation. Ice can form on the bottom of the stream (called anchor ice) or can form in slushy crystals called frazil ice. Frazil ice can harm fish directly through scraping their gills, or even cause suffocation.[94] In general, when ice forms it displaces fish from favourable habitats. Ice sometimes creates dams, which can cause some areas to flood and others to dewater. When dams break, they can crush fish and cause downstream erosion.[95] Not enough is known about ice formation in rivers affected by flow diversions, nor its effects on fish and other aquatic life.

Changes to riparian vegetation

The vegetation that grows along stream banks and lake edges is called "riparian" vegetation. Riparian vegetation often reflects the moist conditions found in these environments, and it influences river ecosystems in many ways.[96] For example, riparian vegetation provides nutrients to food webs, and also provides important fish food directly through terrestrial 'insect drop'. [97] [98] It provides shade, protects river banks from erosion, and helps provide river structure through 'woody debris' – the trees that fall into a river channel and help shape its form, and provide hiding cover and pool habitat for fish. [99] Riparian vegetation can also filter runoff containing harmful sediment or pollutants before it reaches a stream or lake.

Riparian vegetation and ecosystems may be affected by reduced moisture levels due to reductions in instream flows. This can be a problem when rare plant communities rely on stream moisture, for example in high-gradient stream reaches that give off a lot of mist (see 'Life in the Spray Zone'). Conversely, changes to riparian vegetation can affect the stream; a concern when riparian vegetation is removed to make way for dams, roads, powerhouses and power lines. As discussed in the 'Terrestrial Impacts' section of this document, riparian areas also provide essential habitats for terrestrial species.

Life in the Spray Zone: Impacts of river diversions on rare riparian ecosystems
- by Jim Pojar and Patrick Williston[100]

Waterfalls, cataracts, cascades, and wet canyons are striking physical features that are among the hallmarks of British Columbia. But they are more than water and rock. The constant spray and perpetually moist, shady and cool conditions result in unusual ecosystems with a rich assemblage of moisture-loving organisms. These features are small but significant nodes of diversity and specialization, especially in our mountainous forested landscapes.

Although small and generally overlooked, particularly noteworthy are the non-vascular plants. These diminutive plants, which reproduce with spores, include the mosses, liverworts, and lichens. They thrive on the wet rocks, drip faces, and mist-drenched trees and logs of waterfall spray zones and humid canyons. These habitats shelter many rare species of such plants and are critical habitat for several species endemic to our part of the planet. We suspect that many specialized invertebrates also live in these habitats, in addition to better-known vertebrates such as the dipper and tailed frog.

Current environmental assessments of river diversion projects do not adequately address these sensitive ecosystems and species, because:

- These small, obscure organisms are not usually included in environmental assessments, which emphasize impacts on vertebrates—especially fish and mammals.
- Even when they are documented in areas proposed for development, these organisms are not adequately protected by existing legislation and development plans are seldom changed to accommodate them.
- If these sensitive species and ecosystems do happen to get noticed, "mitigation" is typically prescribed. But in these circumstances mitigation would mean re-creating the waterfall or wet canyon and its microclimate—which isn't going to happen.
- The current process promotes progressive erosion of key habitats for rare and regionally endemic species.

Changes to the food web

Aquatic food webs will likely be affected by the reduced habitat quality and quantity caused by river diversions. Benthic invertebrates are the most recognized component of the food web, because they are a primary food source for fish,[101] and are essential for the functioning of aquatic ecosystems.[102] Benthic invertebrates are the larvae of insects such as caddisflies, dragonflies, and mayflies. They live on the stream bottom, and cycle nutrients through eating algae, leaf litter, or other insects. In addition to providing fish food, the types and densities of invertebrates reflect conditions in the stream, which is one reason they are used as a monitoring tool. The presence or absence of sensitive species is a good indicator of habitat quality and of changes over time.[103]

Studies in other jurisdictions have found benthic invertebrate densities dropping by 50% or more as a result of stream diversions. [104] [105] [106] Similar studies have shown dramatic changes in the types of invertebrates present below dams.[107] [108] [109] River diversion proponents in BC usually collect benthic invertebrate data as part of their environmental assessment. Conclusive monitoring results are not yet available, so it is not yet known whether these studies will help to understand impacts to the stream environment and to the food web.

Downstream impacts

River ecosystems are complex, and river diversions could cause problems even downstream of where the flows are returned to the river. This concern is increased when multiple adjacent tributaries of the same river are diverted. The effects of these diversions on a river's ecosystem could be additive, or may even be greater than the sum of the individual impacts.[110]

Dozens of clustered diversion projects are constructed, approved, or proposed in BC, yet their downstream effects receive little attention. This is not surprising, considering it would take a significant amount of research to properly understand this issue. Existing research is not available, in part because river diversion projects are only recently becoming common. However, a great deal is known about the ecological connections between 'headwater' upstream environments and the lower gradient river systems below.

Within river ecosystems, downstream communities are dependent - at least in part – on upstream processes.[111] Water from smaller streams provides a continual source of essential nutrients that supports life downstream. This includes dissolved nutrients[112] as well as drifting aquatic and terrestrial insects.[113] [114] The elements that shape streams – large woody debris and sediment – are also partly provided by upstream reaches.[115] [116] [117] A river diversion can interrupt the supply of sediment and large woody debris, or release large amounts of sediment where alpine lakes are used for storage, as happened at Tyson Creek in 2010.[118] The lowered flows in the diversion reach can also affect the nutrients and food matter delivered downstream, since the wetted width of the stream will be

smaller. For instance, the production of benthic invertebrates in the diversion reach will likely be reduced. This, coupled with seriously reduced flows that would normally provide the transport, will reduce the 'drift' of insects that would typically be available to downstream fish populations. Changes to temperature in the diversion reach may also carry on downstream. Downstream temperature changes may also result from cold upstream waters being discharged from the penstocks. In Norway, river diversions have caused dramatically lower temperatures in downstream salmon-bearing waters, causing devastation to local salmon stocks further explanation, REF AND VALIDATION

An instream flow release guidance document developed for the provincial government has this to say: *"At present, existing data are not sufficient to know with reasonable certainty where the bulk of biological productivity originates in different systems, the extent to which productivity at different sites is interdependent, and what effects hydrologic changes have on that productivity".*[119] In other words, not enough is known about the connections between upstream and downstream environments, or how changes to flow in one site will affect another. This means that it is difficult to predict how reduced flows will affect the aquatic ecosystem downstream of the powerhouse(s).

Eulachon and coastal hydropower

Eulachon are herring-sized fish that are important to coastal ecosystems as well as to First Nations culture.[120] Coast-wide there has been an estimated 90% decline[121] in their numbers, which may be due to warming environments as well as fisheries by-catch and freshwater habitat loss.[122] Due to this decline their populations are listed as endangered (Fraser River and Central Coast populations) or threatened (Skeena/Nass populations).[123]

Eulachon spawn in the lower reaches of some coastal rivers, [124] and use estuaries for rearing. [125] Changes to flow or sediment as a result of hydropower development could put additional pressure on these threatened and endangered populations. For instance, eulachon can be affected by increases in fine sediment in their spawning gravels,[126] and by changes to flow patterns caused by upstream dams or diversions. [127] For those rivers that support eulachon populations, extra care will be needed to understand and monitor the downstream impacts of proposed river diversions.

Effects of project infrastructure and project operations on aquatic life

The environmental impacts of reduced flows are a major focus for regulators and for citizens concerned about preserving river ecosystems. However the day-to-day operation of the facilities and the design and location of the facilities are equally important.

Daily and hourly fluctuations in flow

The fluctuations in flow due to project operation (called 'ramping' and 'peaking') can cause fish kills and can be one of the biggest sources of environmental damage caused by river diversion projects. The 'ramping rate' is the rate of change in flow through a diversion or a dam. 'Peaking' refers to short-term increases in the amount of water diverted, in order to meet power demands and to maximize profits. Flow through the turbines will need to be 'ramped up' when peaking is desired, and 'ramped down' afterwards. Changes to the amount of water diverted will also happen in response to changing water availability, or because of a shut-down or start-up of the power plant.

Natural floods provide warning signals that allow organisms to make the appropriate behavioural responses.[128] However, the unnatural schedules of power production happen too fast for stream life to adapt.[129] In fact, the fluctuations caused by ramping the diverted flow up and down create a 'zone of death' along the shallow margins of the stream channel. [130] [131] These shallow areas are exactly where many insects must emerge to complete life cycles and are also the prime rearing habitat for fishes. [132] Could use better ref The dewatering of these shallow areas can trap or strand fish and can also cause insect 'drift' downstream.[133] Even water quality, water temperature, and the shape of the channel can be affected by the unnatural fluctuations in water levels.[134] The consequences of excessive fluctuation in water levels are fewer aquatic species, and shifts in the types and diversity of aquatic species.[135]

Flow levels drop in the diversion reach (i.e. between the intake and the powerhouse), when flows through the penstocks are increased. Conversely, decreasing flows can be a serious problem for the downstream reach when flows through the penstocks are decreased. Flow ramping is an issue even below the point where flow is restored to the river, because downstream water levels will drop immediately when flows through the penstocks decrease. In longer diversion reaches there may be a lag time of hours before the flow travels through the diversion reach and replenishes water levels below the powerhouse. During this time fish can easily be stranded.

Best practices must be developed in order to avoid serious harm to fish populations and to the stream's ecology in both the diversion reach and downstream. When flows are decreasing, the ramping rate must be slow to ensure that water levels don't drop too suddenly. The ramping rate must be adapted to the local fish species, the water

temperature and season, and whether it is night-time or day-time, so that fish can react by moving into deeper waters.[136 137 138 139]

The tailrace is a short section of constructed channel that returns the diverted flow back to the river. In some projects fish may be excluded from the tailrace by a barrier so that they will not be affected by the dramatically changing flows experienced there.

Monitoring of inflows from upstream, linked in real time to the powerhouse control systems, are used at some facilities to reduce the chance that project operations will cause stranding of fish and dewatering of fish habitat. Better ramping procedures and more monitoring are required to minimize the harm done to fish and insect populations as a result of flow ramping.

Emergency shut-downs of connected projects

Where multiple projects share a transmission line, there is always the possibility that energy generation at these projects will be shut down all at once in response to problems with the line. In this case, problems with quick drops in flow (i.e. overly quick ramping rates) can be additive, translating into major problems downstream.

In the case of the Forrest Kerr river diversion project in northwest BC (now under construction) and the adjacent, proposed McLymont Creek project, simultaneous shutdowns could result in decreases in water depths of almost ten times the site-specific recommended rates, even though the project tailraces are located 10 km away from each other.[140] Similar issues would likely occur in other proposed projects (e.g. Bute Inlet) where multiple adjacent diversions would share a single transmission line.

As is the case for the Forrest Kerr and McLymont Creek projects, many projects are located just upstream of lower-gradient salmon spawning and rearing habitat, which leaves fish more susceptible to stranding due to flow ramping. Flow by-passes that allow some or all of the project flow to be continued through the powerhouse without energy production can mitigate these effects, but only if properly implemented and managed.

Direct harm to fish

Projects must be designed so that fish and other aquatic organisms are not pulled against a penstock's intake screen, or pulled into the penstock itself, thus drawing them into the turbines. This is particularly challenging where small fish such as juvenile trout and salmon are present, especially when juvenile salmon are migrating from their freshwater rearing habitat out to saltwater to begin the adult phase of their life.

Migration barriers

The low dam built to create the 'head pond' is often a barrier for fish, depending on its height and on flow levels. In the majority of river diversion projects the dam is built upstream of a natural barrier to salmon migration, but several projects have been

approved in BC for salmon-bearing streams (most recently the highly controversial Kokish River project). The majority of existing and proposed river diversion projects in BC have resident fish populations in their diversion reaches. Resident fish species include rainbow trout, cutthroat trout, and bull trout, among others. The effects of river diversions on these species are not well studied, though monitoring efforts are now underway. In many cases the dam will divide the local population in two.[141] Long-term negative impacts – like declining populations and loss of genetic diversity – can result through the lack of connection and migration between upstream and downstream areas. Studies in other jurisdictions have proven this to be the case. For example, population decline of bull trout has been seen in Montana above a dam after loss of connectivity with downstream populations,[142] and westslope cutthroat trout above migration barriers have lower genetic diversity than that of downstream populations.[143] Generally speaking, it is well known that habitat fragmentation results in smaller populations and in populations with lower genetic diversity, which are less likely to survive over the long term.[144]

Habitat conversion

The head pond can convert high value riffle habitat into lower value pond habitat. Also, the presence of the dam, tailrace, powerhouse and roads means that valuable riparian vegetation, often including old growth forests, has been permanently lost.

Hydropower 'mishaps'

Emergency shutdowns, mechanical malfunctions, lack of oversight, and the challenges of operating in rugged, remote locations will occasionally cause 'mishaps' that can dry up rivers or damage fish habitat. For instance, the diversion reaches at both the Miller Creek Hydroelectric Project near Pemberton[145] and Rutherford Creek Hydro Project near Whistler have run dry, due to equipment malfunction or lack of onsite management. Other incidents may well have occurred without public knowledge. Incidents like this demonstrate that although good planning and infrastructure may be in place, short-lived, unforeseen events can cause devastating fish kills and damage to fish habitat.

Environmentally devastating incidents can also happen at storage hydropower projects. In spring 2011, a failure in the second of two turbines at a TransAlta hydroelectric facility near Canmore, Alberta (the first was undergoing scheduled maintenance) was followed by unusually large rainfall and snowmelt events.[146] Pent-up water led to flows that were about 50 times normal volumes, likely causing the extermination of Westslope cutthroat trout residing in the Spray River.[147] Sediment released during this event may also affect bull trout in the Bow River, more than 40 km downstream. Likewise, an unexpected sediment release from the lake storage river diversion at Tyson Creek near Sechelt affected the Tzoonie River in 2010, only months after becoming re-operational after a previous shutdown. In this case, unbeknownst to operators, a large sediment deposit was mobilized when the lake level was drawn down by 10 meters, releasing a large plume of fine sediment into Tyson Creek, the Tzoonie River and Narrows Inlet.[148] This event was noticed by members of the public after the sediment plume had already reached Narrows Inlet and the Tzoonie River estuary.

Water use planning

BC Hydro was instructed to undertake water use planning in 1998, to be more responsive to the needs of aquatic life and other non-power uses of dammed waterways and watersheds. According to consultants working on the plans, this was arguably the largest public planning trade-off process in the province's history, and the planning has won numerous sustainability and community-based planning awards.[149]

Water Use Plans cover most of BC Hydro's facilities, and balance the need to produce electricity with other competing uses, such as the need to provide seasonally appropriate flows to the fish populations downstream, as well as recreation, domestic water supply, wildlife and heritage uses.[150] Improved flows will not fully restore these dammed rivers, but many of the remaining fish populations are healthier as a result.[151] Monitoring and adaptive management are ongoing and will result in future management decisions about optimal flow regimes. [152]

BC Hydro had the mandate, the expertise, and the capacity to engage with the public in exercises such as water use planning. Sadly, this progressive planning process is not available with the dozens of private operators now providing BC's new electricity supply. Watershed Watch's mandate does not normally extend to policies for the public vs. private ownership of hydroelectric infrastructure. However, in this instance, public ownership appears to have clear benefits with respect to public accountability as well as for managing for multiple resource uses.

Terrestrial impacts of hydropower

For some hydro developments, disruption and damage to forests, wildlife and plant communities can exceed the harm done to aquatic life. For instance, large dam projects flood entire valley bottoms, which are among the most endangered landscapes on earth.[153] River diversion ('run-of-river') projects can also have major impacts to forests and wildlife, due to the extensive "footprint" of the hydropower infrastructure, including the roads and transmission lines that connect the site to population centres. Many projects are made up of two or more linked diversions. With other existing or proposed projects nearby, this means that cumulative impacts can be severe.

In a nutshell:

River diversion projects put permanent industrial infrastructure into remote areas, removing some areas of wildlife habitat permanently and affecting the quality of remaining habitat. Roads and transmission lines have significant terrestrial impacts, and their effects on wildlife can be profound.[154] Roads and transmission lines fragment habitat, create barriers for some species, change species' behaviour, and kill animals through collisions with vehicles or power lines. Unpaved roads can be a major cause of sediment to nearby streams, and cause landslides when not properly maintained. Roads and construction projects also bring people – including hunters – into formerly inaccessible areas, causing disturbance and wildlife-human conflicts.

Environmental impact assessments identify some likely impacts and propose measures to reduce them. However, the impact of river diversion projects cannot be fully addressed for some species like grizzly bear, marbled murrelet (a seabird that nests in old-growth forests), and rare plants. Little information is available about many of the species and habitats that will be affected by river diversion projects in BC. As a result, projects will proceed based on many assumptions, and problems won't be discovered until after the fact, assuming that project monitoring is effective. Project proponents promise research, adaptive management, and to make new efforts to reduce impacts if problems are discovered. By this point however, the only remedy might be to remove the roads, power lines and other infrastructure that are the cause of the problems.

Permanent infrastructure

River diversion projects consist of a low dam and a pipeline (penstock) to bring water to a powerhouse at lower elevation. The powerhouse can be up to several kilometers away, requiring extensive construction to install the connecting penstock, which can be above ground, buried, or tunneled through bedrock. The powerhouse is connected to a power substation and to a "tailrace" channel to convey water back to the stream.

Most BC river diversion projects will need long roads and power lines to connect them to the towns and cities where the electricity is used. Unlike forestry roads, which are often

deactivated after logging is finished, hydropower access roads need to remain open and be maintained indefinitely. The permanent infrastructure associated with hydropower projects will change the character and habitat value of the surrounding area.

Permanent vegetation clearing

All hydropower projects require vegetation clearing for project infrastructure and for roads and transmission lines. Vegetation clearing disturbs and fragments ecosystems and harms the species that live there.[155] [156] For common ecosystems and species, this is not a cause for alarm. However, for rarer ecosystems or for ecosystems that support sensitive species, changes to even small sites may be devastating.[157] Some species and ecosystems highlighted in **Tamed Rivers** – for example grizzly bear, marbled murrelet and rare plant communities – may be particularly affected by river diversions or other remote energy projects. Populations of species at risk are particularly vulnerable to changes to habitats, especially those species that have already been victims of large habitat loss.

Vegetation will need to be cleared along the stream bank to allow for some of the necessary infrastructure. Riparian vegetation is essential not only for the health of the stream, but also for many terrestrial species. Riparian areas frequently contain the highest number of plant and animals species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. Biologically diverse, these areas maintain ecological linkages throughout the forest landscape, connecting hillsides to streams and upper headwaters to lower valley bottoms. There are no other landscape features within the natural forest that provide the natural linkages of riparian areas.[158] Vegetation clearing in riparian areas will affect many species, and project plans should always minimize the amount of riparian vegetation to be cleared.

Species at Risk

BC has more species at risk than any other province in Canada[159]. Like tropical rainforests, BC has high biodiversity and contains a number of North America's biodiversity hotspots[160]. BC supports tens of thousands of known plant and animal species including countless insects (more than 35,000 species identified) and other invertebrate species, many of which remain undiscovered or unstudied. Many of BC's species are considered "at risk" of becoming rarer, endangered or extinct. Various circumstances can increase the risk that a species might be lost. These include: species that are found only in a small area, species that are particularly sensitive to human use, species that reproduce slowly, or species that have been subject to large habitat loss[161]. The disruption caused by climate change is also a critical issue that may contribute to the loss of species at risk.

Species at risk are not well protected in BC, and the way they are managed can be confusing for project proponents and for the public. The high species diversity in BC makes it difficult to build a project that identifies and avoids significant impacts to species at risk. Inventory and research are critical,[162] since many locations of rare and endangered species have not been studied. The huge species diversity and the lack of existing inventories mean that project proponents cannot be expected to find every species that occurs in a project area. Nonetheless, a lack of information is not an excuse to assume that species at risk are not present or that the impacts of a project can be mitigated. Unfortunately, even if rare species are known to be in the path of development they can still be harmed, as legal protection for BC's species at risk is inadequate.

Requirements for assessments and inventories are less stringent for hydroelectric projects with a capacity of less than 50 mega-watts. Even the larger projects subject to a formal environmental assessment have included unenforceable commitments to protect species at risk[163]. More care is required to ensure that species at risk are accurately identified and protected.

Roads and transmission lines

Roads and transmission lines connect dam and diversion sites to population centres. For remote river diversion projects, these "linear disturbances" can form the greatest part of the project's footprint. Roads come with serious, well documented impacts[164] [165] that include habitat fragmentation, habitat loss, barriers to movement and migration, wildlife-vehicle collisions, changes to habitat use and changes to the way that predators interact with their prey. Increased hunting pressure, increased human-wildlife conflicts, erosion and drainage problems, and landslides are also common outcomes of roads.

Transmission lines and other linear corridors have most of the same impacts as roads, because vegetation is cleared and managed differently, creating a new habitat type. These habitat changes benefit some species at the expense of others. One impact that is particular to transmission lines is electrocution and collisions of birds and bats.[166] [167] Some species, like the marbled murrelet – a threatened sea bird that nests on large, mossy tree limbs – are particularly prone to injury and death due to power lines.

Habitat fragmentation from roads and transmission lines

Primary forces like wind, fire, and insect infestations are the natural disturbances that define ecosystems in different areas of the province. These disturbances influence the size, shape and age of different ecosystem types – like old growth forests or grasslands – and their distribution.[168] The species that live in these ecosystems are adapted to the typical patterns, or 'patch sizes' found on the landscape because of natural disturbance. For example, many coastal wildlife species are dependant on large, continuous patches of older forest, which exist on the coast where fire and windstorms are relatively rare. Roads and other corridors cut these patches into smaller, disconnected fragments. For some species – such as grizzly bear, mountain caribou, northern goshawk and wolf – survival and reproduction are adversely affected when habitat is fragmented. The presence of roads and other corridors can also change the behaviour of different species. For instance, wolves have been shown to use the corridors created by power lines and logging roads to improve their hunting success, although they also appear to avoid areas with moderate or high road densities.[169] [170] [171] [172]

Using roads

Roads bring people to nature, and this leads to conflict with wildlife. For example, roads give hunters access to species like deer and moose. Bringing people into wilderness areas can also cause the death of species like grizzly bear and wolves, due to conflicts with

people.[173] [174] Some animals can also be attracted to salt, seeded grass, and changes to vegetation cover next to roads, increasing their visibility to hunters and predators and making vehicle collisions more likely.[175]

Some animals change their behaviour around roads, even if traffic volume is low.[176] [177] [178] [179] Controlling the numbers of people allowed to use the road can be effective in reducing road impacts to grizzly bears,[180] and could mitigate impacts for other species too. Various methods are available to control access to roads – such as gates, signs, legal road closures, road deactivation, and other barriers – but there are few regulations that support road closures in British Columbia, especially when a history of public road use develops.[181] Road closures are rarely popular with the public and are largely unenforceable.

Factors that affect wildlife deaths on roads include: a) the speed and frequency of vehicles and b) the proximity of habitat cover and wildlife movement corridors.[182] Wildlife species commonly killed by vehicles include snakes,[183] amphibians,[184] and ungulates such as deer and moose.[185] The density of some species like amphibians and small mammals has been shown to decline when roads increase.[186] The problems caused by roads can be addressed for some species, whereas other species remain vulnerable. For example, where roads cross traditional migration paths for frogs or toads, attempts to divert these animals have not been very successful.[187]

Erosion and roads

Roads built to access river diversions are usually unpaved and need to cross steep and rugged terrain. If not carefully managed, runoff from these roads can cause soil erosion and deliver sediment into nearby streams.[188] Landslides are another risk. Until recently, the unpaved roads built in most of these valleys were for forestry purposes only, and had to be built to high standards to avoid typical problems with runoff. These standards are not required for hydropower projects. Even so, proponents may promise to meet these standards. In the only public audit of a river diversion project, the roadwork generally met forestry standards, with the exception of spur roads to access transmission towers. These roads were eroding in many locations and at least one landslide was noted. [189]

Spreading invasive species

Roads create disturbances that allow invasive plants to grow, and vehicles travelling these roads then inadvertently help to move the plant from place to place.[190] A small, new infestation can be the beginning of a costly future problem with implications for the health of local ecosystems and species.[191]At one multi-site river diversion project, investigators noted opportunities for more prompt re-vegetation of disturbed areas and recommended ongoing monitoring to reduce the risk of both soil erosion and the spread of invasive plants.[192]

During construction

The construction phase lasts a few years and human presence and disturbance can be intense. There may be soil erosion, landslides, and accidental spills. There will be chainsaws used to clear vegetation, large machines used to build or improve roads, and rock blasting for roads or penstocks. Major construction activity is required for the dam, penstocks and powerhouse. The noise associated with this activity can be very disruptive to some species such as mountain goats.[193]

Many people will be on site, and in some cases they are housed in large field camps. The behaviour of wildlife can be altered around people[194]. Some species may be displaced and others will be attracted to garbage. For example, bears that develop a history of scavenging garbage risk being killed because they become a perceived danger to humans.[195] [196] [197]

Wildlife trees

Worker safety regulations require that "dangerous trees" be addressed when there is a risk of injury to workers. In practice, this usually means that dead, dying or diseased trees are cut down when they are near work sites, including power lines and roads.[198] Many of these lost trees have high wildlife value, particularly when they are old and large in diameter. Large trees with heart rot (hollow trees) are particularly important for species that use tree cavities, such as bats, birds, and bears.[199] The removal of all wildlife trees in and around a project's footprint is a loss that is difficult to compensate for. Guidance is available on how to safely retain wildlife trees.[200] However, the only recent audit of a river diversion project showed that commitments to leave wildlife trees were not achieved, due to worker safety concerns.[201]

Healthy ecosystems require predators

Predators are a crucial part of healthy ecosystems, because they have major influences on many other species.[202] [203] [204] [205] [206] Despite British Columbia's generally healthy predator populations, the province faces significant challenges in sustaining them.[207] Large predators survive in BC mostly because the province contains large, relatively inaccessible wilderness areas[208]. Elsewhere, populations of grey wolves, grizzly bears, black bears and cougars have been eliminated or greatly reduced. Since 1840, wolf populations in North America have declined by 40%,[209] and grizzlies by 98% (50% in BC).[210] As the province develops new land uses, it is important to consider the risk to large predators. Losing any of the remaining predator populations could affect genetic diversity, making the species less resilient to impacts like climate change.[211]

Studies to understand large predators are expensive and require years to complete, so quality baseline (pre-project) information about local populations is not usually available. This means that projects will usually be approved without extensive study, leaving many questions unanswered. A common approach is to proceed with assurances that problems will be identified and fixed as required. This assumes that post-project monitoring can detect problems, which is not necessarily true without knowledge about pre-project conditions. In many cases, problems could only be fixed by removing the project itself, something that is very unlikely. A more cautious approach is warranted. In some cases this will mean better pre- and post-project monitoring and adaptive management, whereas in others it will mean accepting that the cost of development is simply too high.

Ungulates need special management

Ungulates are hoofed animals; the ungulates native to BC include deer, moose, elk, caribou and mountain goat, mountain sheep, and bison. Many are managed to provide hunting opportunities,[212] and mountain caribou – a sub-species of caribou that live in Interior BC - receive special management because they are a species at risk.[213] Even relatively common ungulate species like elk and moose are sensitive to habitat changes and to roads that make them more visible to hunters. Moose have been found to avoid rural road networks even when these roads are not much used.[214] Similarly, research indicates that elk and mule deer avoid feeding sites near roads, even in seasons when hunting is not permitted.[215] [216] Collisions with vehicles are also a concern. Where new river diversion projects are planned, roads can be designed to reduce the likelihood of vehicle collisions with ungulates and other wildlife.

Ungulate winter habitats should also be located and protected from development. Ungulate winter habitat – referred to as 'winter range' – consists of forested locations with special attributes that allow the animals to feed and survive over the winter when food is scarce and many ungulates die of starvation.[217] [218] [219] [220]

Mountain goats are particularly sensitive to disturbance associated with blasting, road use, and helicopters. Avoiding spring disturbance during kidding seasons is important.[221] [222] Like large predators, ungulates are difficult and expensive to study, but each population has specific land use patterns that may be affected by proposed projects. Gathering this baseline information is critical to ensuring that project impacts can be minimized.

Likely impacts of proposed transmission lines on marbled murrelets nesting on the South Coast of British Columbia
by Dr. Alan Burger[223]

Hydroelectric power projects pose a significant threat to the Marbled Murrelet, a threatened species in Canada which is also covered by the federal Species at Risk Act and is provincially "blue-listed". Marbled Murrelets are dependent on old growth forest for nesting, and on BC's southern mainland these seabirds have been severely impacted by habitat loss due to forestry and urbanization. South coast watersheds staked for hydropower development – such as Bute Inlet – are known to support some of the highest concentrations of nesting Marbled Murrelets on the southern mainland Loss of nesting habitat through logging of old-growth forests is the primary threat to the Marbled Murrelet across its range. The many proposed power projects on the south coast pose three new levels of threat to this species. First, the roads, power-line corridors and construction camps remove large swaths of important and irreplaceable nesting habitat. Second, the fragmentation of the forest increases the risk of nest predation by crows, ravens and jays which are known to be important nest predators along forest edges. Third and most alarming is the risk of murrelet collisions with powerlines. Murrelets fly fast and awkwardly during twilight hours when coastal forests are often dark and misty. For these reasons the risks of fatal collisions with power lines are high. There is no known way to mitigate the risk of murrelet collisions with power lines, nor can forest fragmentation and removal be reversed, at least not while the power project is operating. Environment Canada and the Province are not implementing the recommendations of the Marbled Murrelet Recovery Team on this issue. Run of river projects cannot be considered 'green' if they improve the likelihood that murrelets will be lost from the South Coast.

Climate Change

The predicted effects of climate change will worsen the ecological impacts of river diversions. Climate change will also make water less available during some times of the year, potentially making river diversions less financially attractive and increasing the potential for conflict with instream needs.

According to the provincial government,[224] the following consequences of climate change are likely to happen in British Columbia within this century:

- Average annual temperature may increase by 1ºC to 4ºC.
- Average annual precipitation may increase by 10 to 20 percent.
- Sea level may rise by up to 88 centimetres along parts of the BC coast.
- Many small glaciers in southern BC may disappear.
- Some interior rivers may dry up during the summer and early fall.
- Salmon migration patterns and success in spawning are likely to change.
- The mountain pine beetle — a pest that kills vast tracts of trees — may expand its range.

Adding to the impacts of river diversions

Climate change is putting stress on many species and ecosystems. Rapid shifts in the geographic ranges of some species are already occurring[225] and these shifts will continue to happen. For example, in the Rocky Mountains, cutthroat trout have been displaced by non-native brook and brown trout which do better at warmer temperatures.[226]

The low stream flows that happen in late summer can be very stressful – or lethal – for fish. Unfortunately, the low flow period is predicted to lengthen as a result of climate change, and in fact this is already being seen.[227] [228] This is because of warmer temperatures, glacial retreat and changes to spring runoff.[229] [230]

More and more, salmon and trout are under threat from low flows and increased temperatures during the summer months. Water temperatures in rivers are rising, for example, peak summer temperatures on the Fraser River's main stem have risen 1.5°C since 1940.[231] Climate-related stress is made much worse by human activity – e.g. excessive water withdrawal for agriculture, industrial and domestic demands. [232] Whenever flows are depleted by human uses, the water can warm up more quickly in response to summer temperatures.

Inputs of cooling groundwater allow salmon and trout to survive in many streams,[233] but groundwater is expected to warm in response to increases in average air temperatures. [234] As a result, the range of salmon and trout will likely shrink in summer, while expanding

in areas of higher latitude and altitude.[235] It is difficult to predict exactly what will happen, but one study forecasts that increased temperatures and increased winter flooding will bring about a massive (47%) reduction in habitat for resident trout by 2080.[236] As salmon habitat overlaps with trout habitat, salmon would be affected too.

Many river diversion projects are located on glacial-fed streams. In these streams, glacial melt is an important source of flow in summer. As glaciers shrink, reduced melt water will decrease flows and cause problems with increased temperatures.[237] These changes may even cause the local extinction of fish and other stream life.[238] Warmer temperatures and changes to precipitation can also cause increased flooding in winter, which can harm spawning grounds,[239] reducing the egg-to-fry survival rates.[240] For areas already affected by river diversions, climate stress would add to the existing stressors. For the diversion reaches of hydro projects, extended low flows and increases in temperature will further reduce habitat quality and habitat quantity.

Climate-change related shifts to temperature and flow may act cumulatively or synergistically with the impacts of river diversion projects, causing significant harm. Moreover, the inherent conflict between water for instream flows and water for power production will be exacerbated during the extended low flow times of year.

The terrestrial environment is affected by climate change, too. Many species will be –or already are – challenged by changes to their environment. It is important to reduce other stressors on natural ecosystems in order to provide the best chance for native species to survive into the future. Moving northward (or to a higher elevation) is an important adaptation strategy, though many species can't migrate very fast. Intact natural ecosystems are very important to support native species through climate stresses, and for providing migration corridors to allow plants and animals to make a gradual north-ward shift.[241] [242]

The roads and transmission lines constructed for river diversion projects are a serious cause of ecosystem fragmentation. They will deplete the health of some plant and animal populations, and may also harm the migration corridors important for long term species survival. Good planning is of the utmost important to minimize these risks.

Reducing water availability

For many BC rivers, winter flows are predicted to increase.[243] This is due to changes in precipitation patterns (more rain will fall in winter and flow into the stream instead of being captured as snow). Conversely, a reduced snowpack, earlier melting and reduced glacial melt will result in extended low flows in the summer.[244] [245] [246] Indeed this is already happening.[247] [248] During the early phases of glacier shrinkage, extra melt water is available, followed in later years by reductions in flow. [249] [250] In most of BC, it appears

that the initial phase of increased melt has already passed, and future reductions in summer stream flow are almost certain.[251] [252]

Lower stream flows during the summer will only increase the conflict between ecological flows and power production. Many studies on hydropower and climate change have been completed in the Pacific Northwest, a region that is similar to British Columbia. Some simulations and papers have concluded that there will greater conflict between power production and instream flow requirements.[253] [254] This could have significant implications for river diversion projects in BC. Without water stored in glaciers, bigger storage dams may be the way of the future.[255]

hat's the limit?

ow do we ensure that an ecosystem or ecies isn't pushed past its tipping point? sually the limit is discovered when it's too e, and when it is difficult and costly – or possible - to turn back. Instead, we need determine what we value and plan ahead conserve it. This is best done by modeling ssible futures and determining whether ey might surpass **ecological thresholds** societal limits. For example, it might be cided to conserve grizzly bear and other get species, to maintain views and trails hiking, to manage forests for sustainable rvest of timber and non-timber forest oducts, and to conduct forestry and dropower development in ways that aintain old growth forest, riparian buffers, d migration corridors. The effects of fferent land management choices would be odeled and assessed so that the best urse of action can be agreed to. A good sessment automatically incorporates the mulative effects of past, present and future man activities, such as logging, mining, creation, urbanization, and hydropower velopment, and does so at an appropriate ographic scale. Good land use planning ll then set limits and use post-development onitoring to make sure that ecological and cial values are maintained.

All places on Earth experience some degree of human impact.

Assessing the cumulative effects of small hydropower development

The term 'cumulative effects' refers to the accumulation of human impacts over time, from all sources. Simply put, it is necessary to understand and minimize cumulative environmental impacts in order to prevent "death by a thousand cuts."

All places on Earth experience some degree of human impact. Even in remote areas without human presence, climate change is affecting the distribution and life cycles of many species. British Columbia is blessed with extensive wilderness areas where ecosystems are relatively intact. Even so, most of these areas are part of the forestry land base, and have changed considerably from their pre-European-contact state. Even areas within parks are affected by human influences such as fire suppression.

In BC, cumulative effects of hydropower developments are addressed only if a project under assessment has the potential to generate at least 50 mega-watts (MW).[1] For these projects, the proponent usually provides information about other potential developments and existing developments, and hypothesizes regarding their combined effects. In practice, this procedure is laughably inadequate for at least three reasons: i) business competitors do not generally share their development plans or information on project effects with each other, so even if a company truly wishes to gather all relevant

[1] Projects with a capacity less than 50 MW do not receive a formal environmental impact assessment or address cumulative effects, though they still require the same licenses and approvals. Other land uses such as forestry do not fit into any framework to address cumulative effects.

information, it is not likely to be available, ii) neighboring hydropower developments are excluded from the analysis if there is any uncertainty about their completion, even if they would be enabled by the current project's infrastructure, and iii) above all, the individual project scale of analysis has proven to be the wrong scale to address cumulative effects.

In our view, cumulative effects are the only real effects worth assessing in most environmental impact assessments…. In the long run, what we really need is a shift in the focus of cumulative effects assessment from project assessment to a regional assessment

…eig 2006

Cumulative effects assessment for the East Toba-Montrose run-of-river project

The East Toba-Montrose project (a project with two linked river diversions in the Toba Valley) is a prime example of the problems with the current approach to cumulative effects assessment. Firstly, the assessment used present-day conditions as the baseline for measuring cumulative impacts, despite federal policy guidance which defines cumulative effects as: "changes to the environment that are caused by an action in combination with other **past**, present and future human actions."[256] The timeframe chosen for analysis was only 10 years into the future, even though hydro projects are planned to be operational for 40 to 100 years.[257]

Secondly, future run-of-river projects were not considered, *even though they would depend on the transmission line developed for this project, and even though the project proponent had expressed interest in developing at least 20 nearby rivers.* The Environmental Assessment mentions two of the same company's proposed projects in neighbouring valleys that, if developed, would use the same transmission line. These projects were at the conceptual phase and so were considered to be out of scope. Astonishingly, the Environmental Assessment does not even mention the proposed Upper Toba project, which would consist of three nearby river diversions to be tied in to the Toba-Montrose infrastructure. The Upper Toba project was submitted to the Environmental Assessment Office just three months after the East Toba-Montrose project was approved, and was touted for its lower environmental impact due to reliance on the infrastructure for the East Toba-Montrose project.

The East Toba-Montrose assessment also does not account for any residual effects that are individually inconsequential, but may be cumulatively significant. This is in direct opposition to what the Practitioners Guide[258] describes as, "a fundamental principle in the understanding of cumulative effects."

While the East Toba-Montrose cumulative effects assessment could be improved within the existing framework, it also highlights how cumulative effects assessment done for individual projects does not address the appropriate scale in time or space.

ıt is a Regional Strategic
ironmental Assessment?
R-SEA assesses the potential
ronmental effects (including
ulative effects) of different policy
ces or different development plans.
objective is to inform a plan and a
agement framework for a particular
on. *endnote CCME 2009*

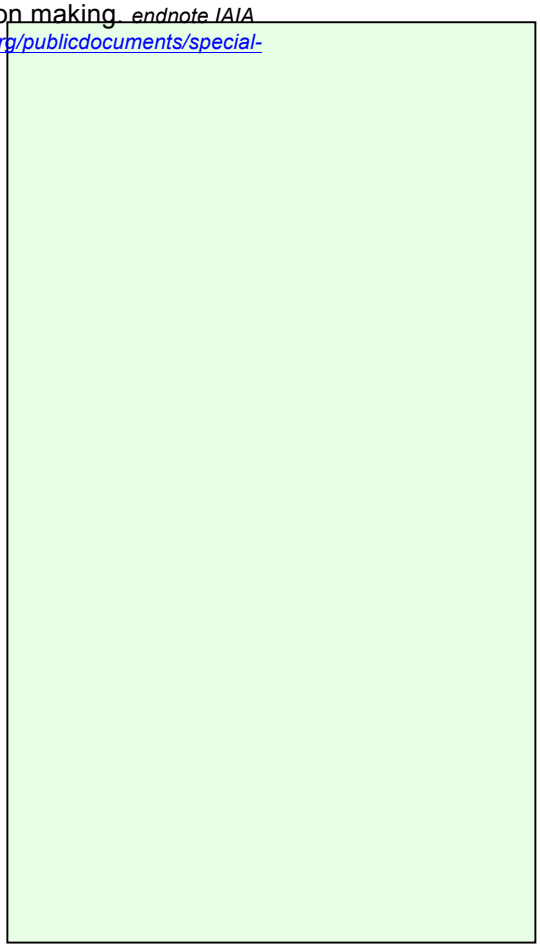
od R-SEA includes:
Collecting baseline data;
Engaging the public in a transparent
process;
Exploring and modeling various
alternatives to meet social and
ecological objectives;
Considering cumulative impacts;
Creating a plan to guide decision-
makers forward.
Monitoring and adaptive
management once the planned land
use is underway.

e from addressing cumulative
cts, R-SEAs streamline project-level
essment and ensure more
ocratic decision making. *endnote IAIA*
http://www.iaia.org/publicdocuments/special-
ations/sp1.pdf

Working at the wrong scale

There is extensive scientific literature[259] detailing how cumulative effects assessment is ineffective when applied to individual projects – and may even do more harm than good.[260] The broad consensus is that the project-level scale of analysis simply cannot address environmental impacts over large enough areas and long enough time scales. Applying cumulative effects assessment to a single project can not properly account for the regional context. This is true for all types of development, and is a key issue for river diversion projects. The local environmental impacts of individual projects will be lower than the impacts of traditional hydropower dams, so can appear relatively benign. However, this comparison does not account for the sum of impacts from neighbouring projects, or the relative impact per mega-watt of electricity produced.

The use of the wrong scale in time and space is a problem that is structurally embedded in Canadian law and policy frameworks for cumulative effects assessment. This same problem also exists in other jurisdictions around the world. As a result, environmental impact assessments usually fail to predict 'significant residual cumulative effects', while there is ample evidence of cumulative effects occurring over time.[261]



The solution regularly proposed is to scale up the analysis[262] to a landscape level and to a timeframe where human activity can be better understood and managed. This is exactly what Alberta Environment is proposing, in recognition that their typical project-by-project cumulative effect assessments are not working.[263] The approach is to do regional land use planning informed by **regional strategic environmental assessments**, which model the potential impact of different land management decisions to help choose the best outcome. An understanding of the likely cumulative effects for different land use choices is a key product.

Many jurisdictions are now filling gaps in project-level assessment through strategic environmental assessments.[264] In Canada, the Canadian Council of Ministers of the Environment is promoting **regional strategic environmental assessments** (R-SEAs) to address cumulative effects, and the council recommends that R-SEAs be used as a tool for regional energy strategies and initiatives, among other things[265]. To be effective, the assessment needs to be a tool used for strategic planning or land use frameworks, as proposed in Alberta with regional planning. There also needs to

e [Forest Practices]
ard's experience has been
t lack of strategic planning
ds to drive project-level
mplaints, which can be
strating and
unterproductive for all.
wever, where a strategic
d use plan was in place,
tisfaction is higher that
est stewardship plans
equately manage and
nserve forest resources.
milarly, satisfaction with
-of-river project plans may
higher if a strategic
vironmental assessment
ocess asks the broader-
ale questions around the
propriate type and level of
velopment, allowing the
sessment of individual
jects to focus on local
pacts.
orest Practices Board, 2011
(toba Montrose report)

be follow-up monitoring and adaptive management, to ensure that the assumptions are correct and that impacts in the real world remain acceptable.

Strategic land use planning to manage cumulative effects

Regional land use planning began in the 1990's in BC, providing a welcome means for public input into land use decision-making. Plans were developed by consensus to direct uses such as forestry and recreation, and to protect ecosystem values; however, hydropower was not a consideration in most regions, because private energy development had not yet become provincial policy.

Since a 2002 policy change that directed BC Hydro to purchase energy from private developers,[266] no strategic energy planning has been done, nor have land use plans been updated to address the new reality. Even the celebrated 2006 Great Bear Rainforest agreement, which set out protected areas and mandated "ecosystem-based management" for over 65,000 km^2 of land on BC's central coast, did not deal with hydropower development.

Strategic planning would go a long way toward addressing public frustration and disenchantment with run-of-river developments and the environmental assessment process in general. Watershed Watch and many other groups[267] have called for a strategic land use planning framework that designates 'go' and 'no-go' areas, so that intact fish and wildlife habitat can be preserved. Strategic planning would benefit project proponents too, as it would give more certainty about the appropriateness of projects, and save the time, expense and frustration caused by dealing with issues beyond a proponent's control.[2]

Perhaps the best reason to do strategic land use planning is to deal with cumulative effects. Project proponents are simply not equipped to address cumulative effects at the appropriate scale, nor do they have the authority to do so. This is acknowledged in the "Terms of Reference for the Bute Inlet Hydroelectric Project Environmental Assessment"[268], which asks the proponent to identify cumulative effects measures out of their control and talk to those with the authority to act. This approach is clearly ineffectual, but is an attempt to address the issue within the limited scope of an environmental assessment.

[2] Plutonic Power (a major developer of run-of-river power) is on record as supporting strategic planning for these reasons. Personal communication DATE (*TG will find the date once her old daytimers are unpacked)*

Liquified Natural Gas in British Columbia

High natural gas prices overseas have sparked a frenzy of extraction in Northeastern BC. To allow the gas to be exported there are plans to build at least five liquefied natural gas (LNG) terminals around Kitimat and Prince Rupert.

Converting gas to LNG is extremely energy intensive.[269] For example, just one LNG terminal (Kitimat LNG) would use almost all of the energy that would be produced from the proposed Site C dam. Premier Clark has announced that the two currently approved LNG terminals (Kitimat LNG and BC LNG) will be powered with 'clean' energy[270], and that development of the Site C dam as well as private power projects (including river diversion projects) must proceed in concert with natural gas extraction.[271] However, it is extremely unlikely that hydropower or other renewable energy options can provide the massive amounts of power required. In fact, all the currently operating river diversion projects in BC don't produce enough power for even one LNG plant. Thus it appears that hydropower is being used to make the environmentally damaging extraction and export of natural gas appear more 'green' than it really is.

Cumulative effects of the Northwest Transmission Line: A gateway to mines and river diversions in the "Serengeti of the North"

The recently-approved Northwest Transmission Line (NTL) project provides a perfect example of how cumulative environmental impacts are not being adequately addressed in BC. Billed by the federal and provincial governments as a piece of "green" infrastructure that would negate the use of diesel generators in northern communities[3], the 287-kilovolt powerline is viewed by many analysts as a gateway to massively increased mining and hydropower development in a region so rich in wildlife it has been described as the "Serengeti of the North". Indeed, the only diesel-powered community that would be reached by the line is Iskut, a settlement of about 350 people, requiring less than 1% of the powerline's 260 MW capacity. However, the five most likely contenders out of the region's dozen or so proposed and approved mines[4] would require an estimated total of 234 MW of electricity. [5]

The NTL's true purpose was partially acknowledged in the powerline's environmental assessment, which required a cumulative effects analysis to consider the effects of new and existing mines, as well the effects of roads, existing human settlements, and forestry activities, in addition to the footprint of the transmission line itself. Astoundingly, only 2

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[3] Government of Canada, "Prime Minister Harper announces ecoTrust funding for B.C.," news release, March 13, 2007, http://ecoaction.gc.ca/news-nouvelles/20070313-eng.cfm

[4] Estimate of number of mines based on projects listed with the BC Environmental Assessment Office (http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_list_report.html) and referenced in *Highway 37 Transmission Line Issues and Considerations* (see reference below).

[5] *Highway 37 Transmission Line Issues and Considerations*. Unpublished draft internal memorandum. The Pembina Institute. August 2008. Accessed at: http://thetyee.ca/News/2011/07/17/Pembina-internal-Memo.pdf on Mar.2, 2012.

of the region's 12 or so proposed and approved new mines and only one of the region's 60+ potential hydroelectric projects were included in the analysis, even though most of these potential projects would be enabled by the existence of the powerline. That one hydro project was the already-approved Forrest Kerr hydropower project on the Iskut River.[6]

The Forrest Kerr project itself provides an excellent example of how cumulative impacts may go unaddressed due to piecemeal environmental assessments that allow proponents to avoid triggering more rigorous screening. Originally proposed for the purpose of powering the nearby Galore Creek mine, the project was to consist of a 100 MW diversion and low-voltage roadside transmission line, and it received a provincial EA certificate in 2003.[7] At the time, conservationists chose not to oppose the project after giving it careful scrutiny and consulting with First Nations. The project design has since been amended five times, nearly doubling the capacity to 195 MW, and now requiring a high-voltage transmission line with separate right-of-way, and a 3-km diversion tunnel, 10 m in diameter, whose construction would generate an estimated 850,000 tons of waste rock that was not drill-core tested for acid drainage potential. Amazingly, a new provincial assessment was never required, and the 195-MW project was still under the 200-MW threshold for a federal "comprehensive" assessment. Since approval of this increased capacity and the NTL, the proponent (AltaGas) is actively pursuing two additional nearby projects, only one of which (McLymont Creek – 70 MW) will go through the provincial EA process, while the other new project (Volcano Creek – 18 MW) is below the threshold that would trigger a provincial EA. A precautionary assessment process would have viewed the 3 clustered diversions sharing a single transmission line and a single proponent as a single project well above the federal government's 200-MW threshold for "comprehensive" assessment.

In the end, the cumulative effects analysis for the NTL could be viewed as pointless. The Environmental Assessment Office accepted the proponent's conclusion that of the 15 Valued Ecosystem Components identified in the analysis[8], none would be adversely affected by the cumulative impacts of the powerline and multiple mines and hydro projects that it would enable[9] – a conclusion not shared by area residents[10]. The Red

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[6] *Northwest Transmission Line Project: Application for an Environmental Assessment Certificate*. Volume 1. Prepared by Rescan Environmental Services Ltd.; prepared for British Columbia Transmission Corporation; submitted to the BC Environmental Assessment Office; accessed at http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_299_32053.html on Mar. 2, 2012.

[7] http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_161.html

[8] The 15 VECs analyzed (from Table 7.1-1 of *Northwest Transmission Line Project: Application for an Environmental Assessment Certificate*): Atmospheric Environment; Surface Water and Groundwater Resources; Terrain, Surficial Materials, and Soils; Geotechnical Stability; Fish and Aquatic Habitat; Wetlands; Terrestrial Ecosystems and Vegetation; Wildlife and Wildlife Habitat; Cultural; Visual Resources and Aesthetics; Socio-economic; Land and Resource Use; Transportation and Utilities; Archaeology and Heritage; Human Health

[9] From the proponent's accepted EA application: All potential cumulative effects were assessed as not significant with the exception one potential adverse cumulative effect; removal of cedar, which is rated as significant even in the absence of the Project. The Projects contribution to this potential cumulative effect is considered minor, due to proposed mitigation efforts and the small percentage that it would contribute to

Chris mine alone is projected to produce more than 180 million tonnes of tailings and approximately 300 million tonnes of waste rock, requiring 200 years of treatment for acid-rock drainage. Several fish-bearing streams would be dammed and used as storage pits for this toxic waste, along with a trout-bearing lake. Red Chris would also destroy valuable habitat for Stone's sheep and other wildlife.

A proposed strategic planning framework

Managing cumulative effects requires a planning framework informed by an assessment (e.g. a regional strategic environmental assessment) that determines the ecological limits to development. A strategic planning framework would designate 'go' and 'no go' zones for energy development, or could use a traffic light approach - using red, yellow and green land use zones to indicate where development is and is not acceptable.[272] This approach would be a 'coarse filter' that would help guide development to appropriate areas.

There are many examples of this kind of planning in other jurisdictions, including sensitivity mapping for wind farm locations in Scotland,[273] and strategic environmental assessment for tidal power in the Bay of Fundy, Nova Scotia[274]. Other efforts include mapping and modeling of species and ecosystems in the Tongass region of Alaska, to help decision makers identify priority areas for conservation[275]. Strategic planning will generally produce multiple scenarios to choose among, and society will have decisions to make about the trade-offs inherent in each proposed solution.

British Columbia has a great deal of existing information to use in a planning framework. For instance, areas unsuitable for development have been identified under BC's forestry legislation, such as deer and goat winter range, old growth management areas, and riparian management areas. (While hydropower development is often allowed in these locations, they still indicate areas that should be preserved.) More work would be required to identify key areas where energy development should not happen – such as important habitats for sensitive wildlife and fish species, rare plant communities, wildlife movement corridors, and development-free areas to support wide-ranging species such as grizzly bear. In fact, this work has already been done for other purposes and could be updated for hydropower planning. The Nature Conservancy of Canada has developed Conservation Blueprints[276] for the different ecoregions of BC, as a strategy for the long term survival of native species and communities. An example of this work is provided in Figure X, overlain with existing and proposed power developments. While these proposed conservation areas were created using land use assumptions that did not include hydropower development, they still clearly demonstrate the need for regional planning to avoid cumulative ecological impacts. More valuable information will come from research at Simon Fraser University, which will use a scenario-based approach to prioritize watersheds suitable for hydro development in BC, based on their ecological integrity and

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the overall cumulative effect. There is also one potential beneficial cumulative effect to which the Project's contribution is major: economic opportunities including and future mining and IPP projects.

[10] http://thetyee.ca/News/2011/01/13/Stikine/

energy return on investment.[277] Once complete this will be a very useful resource for provincial planning.

The BC Environmental Assessment Office (BCEAO) has said they are committed to continuous improvement of the way they oversee cumulative effects assessments and that they are open to feedback on how this can be done.[278] While commendable, the BCEAO is not in charge of strategic land use planning. Any such planning would need to be done under the guidance of BC's resource ministries and be informed by a strategic environmental assessment that takes into account social and environmental objectives and specifies limits to development.

For BC, the best outcome would be a strategic plan that includes all renewable energy options, to help us develop energy that is green as well as clean. Any plan should take into account the predicted and ongoing effects of climate change, in order to remain relevant into the future. BC has renewable energy potential that is the envy of other jurisdictions. With our committed citizenry, with a government that wants to be a world leader in supplying clean, green power[279], and with solid science to inform decisions, we should be able to produce a world class plan.

What about Site C?

BC Hydro is moving forward with plans for their proposed Site C hydroelectric dam. They state that Site C is required to meet future hydroelectricity needs, as well as to provide back-up for intermittent power such as wind power (or more likely, run-of-river hydropower). Many people are upset about the prospect of the Peace River valley being further flooded for this project, and worry that much of the power produced would be used for nearby shale gas extraction, which in turn would be primarily used in the Alberta tar sands for bitumen extraction. Others have argued that extensive and more harmful run-of-river hydropower development may be required to produce the same amount of electricity – see Table 1. Without strategic energy planning, we don't know the best way to develop new energy in BC. Of course, aggressive energy conservation could negate the need for some or all new electricity development. BC Hydro has a goal of meeting 66% of the future demand through conservation measures. We use two and a half times the energy per capita than Germans or Britons do,[280] so we should be able to go even further. However, a fairly dramatic cultural change would be required in order to avoid new electricity development in BC.

Table 1: A comparison of of the proposed Bute Inlet ROR Project and the proposed Site C project*

Feature	Bute Inlet Proposal	Site C Proposal
Energy potential	1027 megawatts	1100 megawatts
Energy to be generated annually	2906 gigawatt hours	5100 gigawatt hours

Number of streams dammed	17	1
Transmission line total length	443 km	77 km
Access road length	271 km	<10 km
Total length of penstocks	85 km	n/a
Direct project footprint	60 km2	84 km2 including reservoir (Reservoir 53.4 km2)
Overall project area	~400 – 500 km2	~100 km2
Efficiency and reliability	Dependant on seasonal flows that are out of phase with seasonal energy requirements in BC	Stable year round flows for highly efficient water use

In presenting this comparison we are not attempting to promote Site C, but to illustrate the importance of open and transparent energy planning so that each renewable energy option can be utilized most effectively.

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A case for planning

Some valleys and rivers simply cannot support hydropower developments without suffering serious and irreparable harm. In other instances, sensitively planned projects can be built without placing fish and wildlife populations at risk. While project planning and siting is important, Watershed Watch's focus is not on making individual projects better. The bigger need is to acknowledge and manage the collective impact of the many projects under development.

British Columbia has done no planning to determine the best placement of hydro projects for environmental and social values. Instead, projects are proposed by private developers and evaluated one-by-one with little regard to the bigger picture. This happens even though Canadian law requires an assessment of cumulative effects for projects with a proposed capacity of at least 50 mega-watts. In theory, cumulative effects assessments look at changes to the environment that are caused by a proposed project in combination with other past, present and future human actions – including other hydro projects. In practice, the cumulative effects assessments done for individual projects almost always decide that cumulative impacts will not be a problem. Generally speaking, this outcome has more to do with the narrow scope of investigation than with the actual likelihood of cumulative impacts.[281]

The failure of project-scale cumulative effects assessment is not unique to BC. Other provinces and countries share the same problem. Many jurisdictions are now addressing the deficits in project-level assessment through strategic environmental assessments.[282] [283] In Canada, strategic environmental assessments have been defined by the Canadian Council of Ministers of Environment, and are called 'Regional Strategic Environmental Assessments.'[284] A strategic environmental assessment offers a way to assess the potential environmental effects (including cumulative effects) of different policies and plans, and is a critical tool for land use planning.

This kind of strategic planning is what Watershed Watch and other groups[285] have been calling for for years. Taking this big-picture approach would alleviate the frustration felt by many citizens whose concerns are not heard in the current process. It would also spare time and expense for developers, since areas inappropriate for hydro development would be identified as off limits.

Strategic and regional planning in BC

The Province of BC could take various paths towards better energy planning. With respect to river diversions, Watershed Watch recommends the following process, which is similar to a Regional Strategic Environmental Assessment as proposed by the Canadian

Council of Ministers of Environment.[286] Efforts should be focused on the hot spots for river diversion developments, such as BC's south coast.

A data-gathering and scenario-modeling exercise for river diversion hydropower

This exercise would illustrate the effect of different land use choices on environment values such as healthy salmon or grizzly bear populations. This kind of process is the only way to understand and manage cumulative effects.

Various resources and data are already available for this exercise, including publicly held data on identified wildlife,[287] existing land use plans, and conservation mapping and other work done by non-profit groups[288] and academia.[289] The chosen methodology should map and model areas of high biological value such as important wildlife habitats, old forest, sensitive plant communities, wildlife movement corridors, development-free areas for biodiversity conservation, and high value fish and riparian habitats.

Mapping and computer modeling would be used to simulate the likely outcomes and levels of risk that would result from different development decisions. The end result would be one or more proposed 'coarse filters' to guide river diversion developments to appropriate areas, and to leave the areas with the highest ecological values undeveloped. In areas where other types of renewable energy developments are likely, those options should also be included.

Using scenarios for land use planning

The outcomes from scenario modeling should be used as a tool for making land use choices. Some areas will be deemed appropriate for development, others may be appropriate depending on local circumstances and project plans, and some areas will be simply inappropriate for any form of renewable energy development.

The province should be prepared to revoke water licenses in areas inappropriate for development. Many water licenses for power generation have been issued all over the province because they effectively provide a company with first rights to develop an area. While many of these licenses won't be utilized in any case, it is important to remove the possibility of development in areas that support crucial ecological values.

Another important outcome of land use planning could be the coordination of different developments occurring in the same region. For example, planning for a shared transmission line could reduce the expense and impact of competing transmission lines.

Public input on land use values and scenarios

Land use planning is as much about social values as it is about scientific data. Only society can (or should) choose between different outcomes for publicly owned land. This is because trade-offs between different values are inherent in any land use choice. Mapping and computer modeling provide the basis for discussion about land use

alternatives so that the most acceptable future outcome can be chosen. Good planning will generate more than one future scenario to choose between. The final scenario chosen will be used to guide land management decisions into the future. The public and local First Nations need to have meaningful input into the scenarios and into the final land use plan.

Public land use planning can be a protracted and expensive undertaking. With a carefully designed framework for public input it should be possible to streamline this process.

Monitoring and adaptive management

Monitoring and adaptive management is required at two scales:

i) Project scale. Monitoring of selected parameters of concern is ongoing for most river diversion projects in BC. In recent years, provincial monitoring requirements have become more rigorous and include the health of fish and benthic invertebrate populations as well as information about flow volumes and changes to the stream channel. These data are invaluable and need to be fully analyzed and shared to inform all river diversion projects in the planning stages. The Ministry of Environment requires adequate staffing levels for this task.

ii) Regional scale: Land use planning involves assumptions about how different land uses will affect social and ecological values. Once regional land use/energy development plans are in place, follow-up monitoring is essential. This monitoring will validate planning assumptions and allow for a course correction if impacts are greater than expected. Together with good planning, this is the only way to manage cumulative effects from river diversion hydropower as well as other land uses.

A BC renewable energy strategy

BC has remarkable potential for most forms of renewable energy. River diversion hydropower is best planned within a framework that includes large storage dams (such as Site C) as well as wind and tidal power. Ideally, the exercise described above should include all forms of renewable energy, not just river diversion power. Experts need to be engaged to help BC develop the best path forward

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ega-watts: the next frontier

ny energy we can conserve will help us avoid the environmental damage caused by w electricity development. BC has made strides towards the more efficient use of ectricity; however, there are still many untapped opportunities. Realizing these portunities requires creative thinking and willingness on the part of the government, C Hydro, and others to ensure that energy conservation and efficiency are the highest iority.

ow to get there:

mplement an appropriate mix of incentive programs, rate structures, and regulations that all cost-effective opportunities to reduce electricity consumption are pursued - that is, wherever the cost of efficiency and conservation is less expensive than the ll environmental, social and economic cost of new supply. This should include storing funding to LiveSmart BC.

Pilot innovative programs like Local Improvement Charges and Pay-as-You-Save odels, and deploy them at scale as soon as possible to make it easier for families and usinesses to use energy more efficiently.

Seek new supply options only after the BC Utilities Commission has confirmed that l cost-effective energy efficiency opportunities are being pursued.

urrently, BC Hydro has a goal of meeting 66% of the future demand through nservation measures. We use two and a half times the energy per capita than ermans or Britons do,[1] so we should be able to conserve even more than planned, ithout sacrifice to our quality of life.

The Best Place on Earth

BC's current strategy for new electricity development does not serve us well. We can do better in a province that wants to be 'The Best Place on Earth.' In fact, BC is one of the best places on earth for renewable energy potential. With our natural and human capital we can be leaders in sustainable energy development.

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