

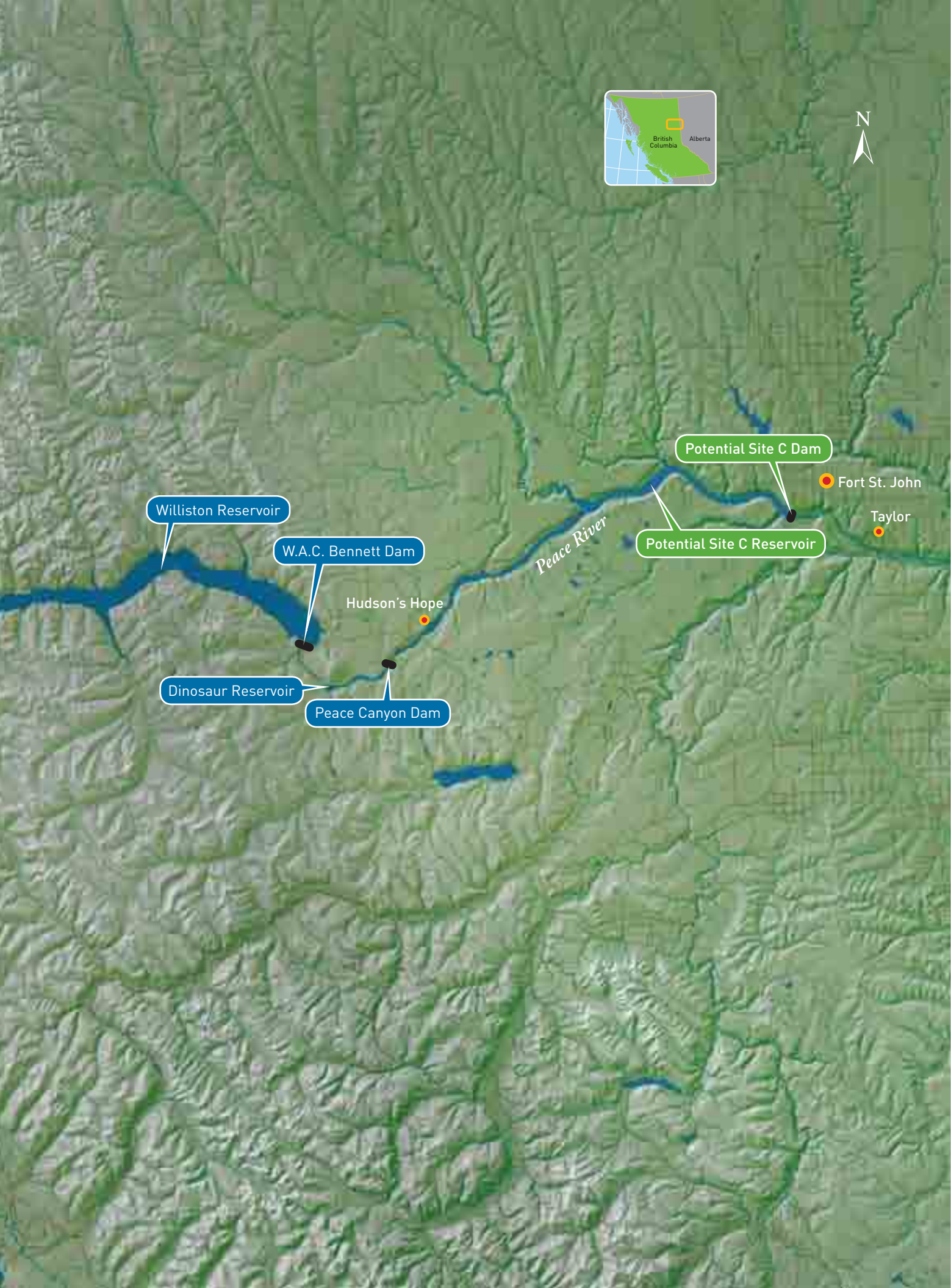
PEACE RIVER SITE C HYDRO PROJECT

A POTENTIAL SOURCE OF CLEAN, RENEWABLE
AND RELIABLE POWER FOR GENERATIONS

STAGE 2 REPORT:
CONSULTATION AND TECHNICAL REVIEW
FALL 2009

BChydro 

FOR GENERATIONS



PEACE RIVER SITE C HYDRO PROJECT

A potential source of clean, renewable and reliable power for generations

STAGE 2 REPORT

This Stage 2 report provides an overview of BC Hydro's consultation on the potential Peace River Site C Hydro Project (Site C), as well as its engineering and environmental work to further define the project.

Stage 2 commenced in the fall of 2007. It included consultations with the public, stakeholders, communities, Aboriginal groups and property owners, as well as early discussions with the Province of Alberta and the Northwest Territories.

As part of Stage 2 work, BC Hydro initiated field studies to better understand current conditions related to the physical, biological and socio-economic environment, and to gather engineering and technical information regarding the design, construction and operation of the potential project.

BC Hydro's work on Site C was undertaken in the context of B.C.'s future electricity needs and provincial energy policy.

The studies and reports used to compile this Stage 2 report are available at www.bchydro.com/sitec.

Fall 2009

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ACRONYMS AND ABBREVIATIONS

BCEAO	B.C. Environmental Assessment Office	IEP	Integrated Electricity Plan (2004 or 2006)
BCTC	British Columbia Transmission Corporation	IPCC	Intergovernmental Panel on Climate Change
BCUC	British Columbia Utilities Commission	IPP(s)	Independent Power Producer(s)
CDA	Canadian Dam Association	kV	Kilovolt
CEAA	Canadian Environmental Assessment Agency	LTAP	Long-Term Acquisition Plan
CO ₂ e	Carbon Dioxide Equivalent	MDE	Maximum Design Earthquake
CPCN	Certificate of Public Convenience and Necessity	MW	Megawatt
DSM	Demand-Side Management	PAD	Peace-Athabasca Delta
EPA	Electricity Purchase Agreement	PMF	Probable Maximum Flood
GHG	Greenhouse Gas	PMP	Probable Maximum Precipitation
GWh/yr.	Gigawatt Hours Per Year	TAC	Technical Advisory Committee
ha	Hectare	UEC	Unit Energy Cost
ICOLD	International Commission on Large Dams	VAR	Volt-ampere-reactive

EXECUTIVE SUMMARY

INTRODUCTION

- The Peace River Site C Hydro Project (Site C) is a potential third dam and hydroelectric generating station on the Peace River in northeast B.C. If built, Site C would be a source of clean, renewable and reliable electricity for over 100 years.
- In keeping with best practices for large infrastructure projects, BC Hydro adopted a multi-stage approach for the potential Site C project. The multi-stage approach provides for an informed decision-making process by allocating multiple milestones for assessing the project and deciding whether to proceed to the next stage.
- Stage 2 commenced in the fall of 2007. Activities during this stage included extensive consultations with the public, Aboriginal groups, property owners, stakeholders and communities, as well as early discussions with the Province of Alberta and the Northwest Territories. This stage also included the initiation of field studies to better understand current conditions related to the physical, biological and socio-economic environment, and to gather engineering and technical information regarding the design, construction and operation of the potential project.

MEETING B.C.'S LONG-TERM ELECTRICITY NEEDS

- BC Hydro forecasts that the province's electricity needs will grow by 20 to 40 per cent over the next 20 years.
- As extensive as BC Hydro's hydroelectric assets are, they will not be enough to provide future generations of British Columbians with electricity self-sufficiency if demand continues to grow as projected.
- While using less electricity and using it wisely through conservation and energy efficiency is the first and best choice to meet future electricity needs, new electricity resources — both large and small — must be considered.
- BC Hydro's Long-Term Acquisition Plan (LTAP) indicates that Site C is an attractive resource option to help meet the growing demand for electricity in B.C.



Peace River at the potential Site C dam site location.

PUBLIC AND STAKEHOLDER CONSULTATION

- Public and stakeholder consultation activities in Stage 2 were multi-phased and offered many opportunities for public involvement.
- BC Hydro conducted three rounds of consultation between December 2007 and December 2008. Many hundreds of people participated in 121 meetings over the three rounds of consultation, including 103 stakeholder meetings and 18 open houses.
- During consultation, participants expressed a strong interest in avoiding or mitigating local impacts from the potential Site C project, particularly possible socio-economic effects associated with an influx of construction workers. Environmental concerns were also raised, including potential effects to air quality, water and agricultural land.
- Overall, 57 per cent of consultation participants “strongly” or “somewhat” agreed with pursuing Site C if conservation, upgrading existing equipment, and investing in new sources were insufficient to meet the electricity needs of B.C. More than two-thirds (69 per cent) of provincial consultation participants agreed with this, while in the Peace region, consultation participants were evenly split on their level of agreement (47 per cent agreed and 47 per cent disagreed).



ABORIGINAL CONSULTATION AND ENGAGEMENT

- During Stage 2, BC Hydro initiated consultation and engagement with 41 Aboriginal groups consisting primarily of Treaty 8 First Nations in B.C., as well as Aboriginal groups in Alberta and the Northwest Territories (NWT).
- The primary purpose of this consultation is to provide information to Aboriginal groups about the Site C project, identify their interests and concerns, obtain their feedback, and increase knowledge and understanding about the potential effects and impacts of the project.
- Consultation agreements were negotiated where BC Hydro determined that more in-depth engagement was required. Eight consultation agreements representing 13 Aboriginal groups were negotiated during Stage 2.
- Aboriginal consultation for the Site C project is ongoing. BC Hydro and Aboriginal groups are engaged in a thorough consultation and engagement process that would continue through all stages of the project, should it proceed.

PROPERTIES AND HIGHWAY 29 CONSULTATION

- As part of its Stage 2 work, BC Hydro representatives met with individuals whose property could be directly impacted by the realignment of four sections of Highway 29 and/or flooding. The purpose of this consultation was to keep property owners informed about the potential Site C project and gather feedback.
- During Stage 2, BC Hydro conducted more detailed mapping of the lands that would be affected by the potential reservoir area. There are approximately 5,340 hectares of flooded land in the reservoir area, of which 81 per cent is Crown land, 12 per cent is owned by BC Hydro and seven per cent is privately owned land.
- If a decision is made to advance the potential Site C project to the next stage, BC Hydro would continue to consult and liaise with affected property owners and leaseholders.

ENGINEERING AND OPERATIONS

- During Stage 2, BC Hydro undertook additional work on outstanding technical issues related to the design, construction and operation of the potential Site C project.
- As would be expected, there have been many changes in guidelines and construction practices since the majority of the design work and key design choices were made in the late 1970s and 1980s.
- As a result of Stage 2 engineering work, BC Hydro has concluded that a refined and updated design is required to meet current seismic, safety and environmental guidelines and to incorporate input from consultation.

ENVIRONMENT AND SOCIO-ECONOMIC

- During Stage 2, BC Hydro set out to identify potential issues and to characterize the current physical, biological and socio-economic environment in the potential Site C project area.
 - Environmental and socio-economic studies — primarily baseline surveys — were completed for the following topics:
 - Fish and aquatic habitat
 - Wildlife and vegetation
 - Water quality
 - Local climate
 - Greenhouse gas emissions
 - Heritage
 - Community services and infrastructure
 - Economic
 - Land and resource use
 - Based on this work, BC Hydro has built on its historic understanding of issues and current conditions in the potential project area. Should the project proceed to an environmental and regulatory review, technical studies would advance from baseline to effects assessment, which would determine the potential effects of the project, and identify ways to avoid or minimize undesirable effects and enhance desirable effects.
- BC Hydro's recommendation to advance the Site C project to Stage 3 considered the following key findings:
 - Compared to other resource alternatives, Site C continues to be an attractive resource option from the perspective of reliability and cost.
 - If built, Site C would be a clean and renewable source of firm and dependable electricity for over 100 years.
 - Site C would produce among the lowest GHG emissions, per gigawatt hour, when compared to other forms of electricity generation.
 - Site C would gain significant efficiencies by taking advantage of water already stored in the Williston Reservoir. This means that Site C would generate 30 per cent of the electricity produced at the W.A.C. Bennett Dam, with only five per cent of the reservoir area.
 - As a source of dependable and flexible electricity, Site C would support the development of renewable resources in B.C. by providing a reliable backup to those renewable resources that are intermittent, such as wind, run-of-river hydro and solar.
 - Site C would create an estimated 35,000 direct and indirect jobs through all stages of the project.
 - Should the provincial government decide to advance Site C to the next stage, key components of this stage would include:
 - An independent environmental and regulatory review.
 - Refining and updating the project design to incorporate current seismic, safety and environmental considerations, as well as input from consultations.
 - Updating the interim project cost estimate based on an optimized project design.
 - Advancing environmental and socio-economic studies from baseline work to effects assessment, including options for avoiding or mitigating impacts.
 - Continuing to consult with Aboriginal groups.
 - Continuing project consultation and community relations with the public, communities, property owners and stakeholders.
 - Advancing discussions with the Province of Alberta and the Northwest Territories.

CONCLUSION

- Based on the Stage 2 key findings, BC Hydro recommends proceeding to the next stage of project planning and development, including an environmental and regulatory review.

1.0 INTRODUCTION

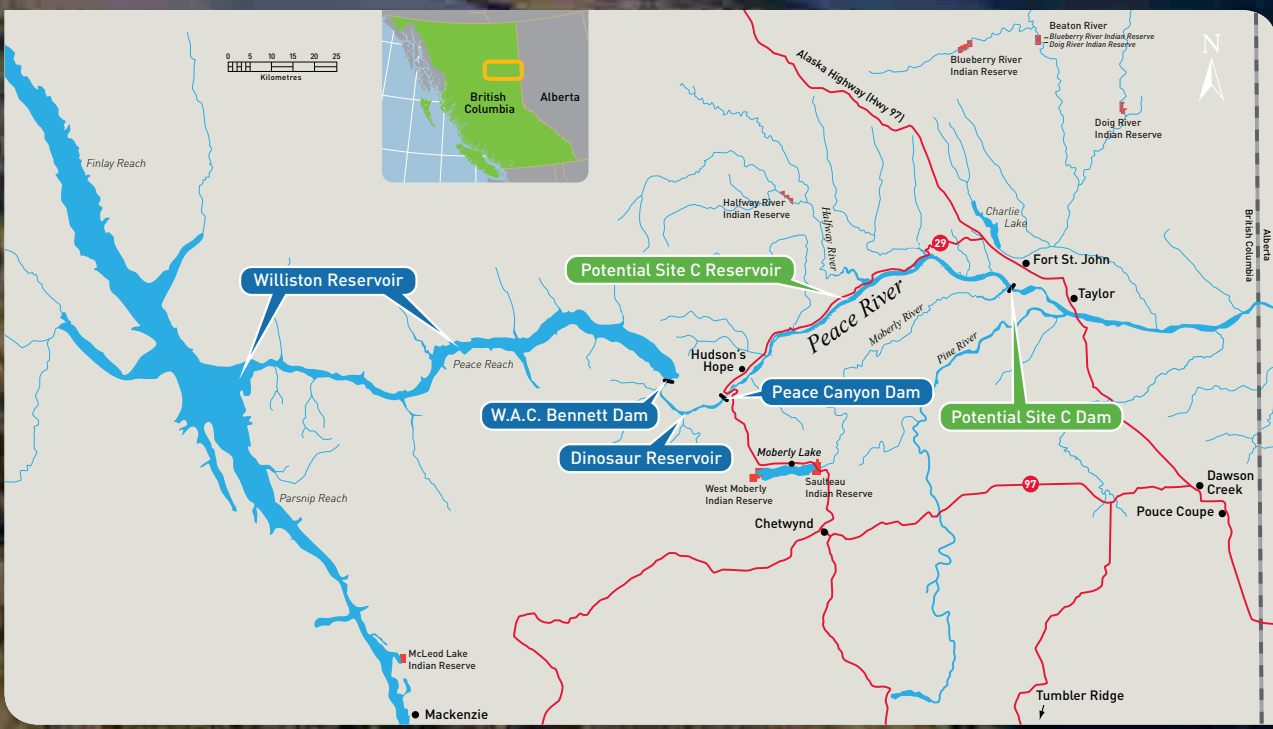
CHAPTER HIGHLIGHTS

- The Peace River Site C Hydro Project (Site C) is a potential third dam and hydroelectric generating station on the Peace River in northeast B.C. If built, Site C would be a source of clean, renewable and reliable electricity for over 100 years.
- In keeping with best practices for large infrastructure projects, BC Hydro adopted a multi-stage approach for the potential Site C project. This report represents the completion of Stage 2, Consultation and Technical Review.
- Stage 2 commenced in the fall of 2007. Activities during this stage included extensive consultations with the public, Aboriginal groups, property owners, stakeholders and communities, as well as early discussions with the Province of Alberta and the Northwest Territories.
- This stage also included the initiation of field studies to better understand current conditions related to the physical, biological and socio-economic environment, and to gather engineering and technical information regarding the design, construction and operation of the potential project.

This chapter provides an introduction to BC Hydro's Stage 2 work on the potential Peace River Site C Hydro Project. It includes general background information on the Site C project,

including its history and why it is being pursued as a potential resource option. This chapter also outlines the multi-stage approach being used by BC Hydro to assess the project.

FIGURE 1-1: LOCATION OF THE POTENTIAL SITE C DAM



As currently designed, Site C would be located downstream from the existing Williston Reservoir and two existing BC Hydro generating facilities.

1.1 BACKGROUND

1.1.1 ABOUT SITE C

Site C is a potential third dam and hydroelectric generating station on the Peace River in northeast B.C. and is one of many resource options being considered to help meet British Columbia's future electricity needs.

As originally designed, Site C would be located downstream from the existing Williston Reservoir and two existing BC Hydro generating facilities. It would include an earthfill dam, approximately 1,100 metres in length, and 60 metres high above river level. The reservoir would be 83 kilometres long and would be, on average, two to three times the width of the current river. It would have relatively little fluctuation in water levels, with a proposed maximum normal operating range of 1.8 metres.

As the third dam and generating station on the Peace River, Site C would gain significant efficiencies by taking advantage of water already stored in the Williston Reservoir upstream of the existing W.A.C. Bennett and Peace Canyon dams to generate electricity. If built, Site C would generate about 30 per cent of the electricity produced at the W.A.C. Bennett Dam, with only five per cent of the reservoir area. Site C would provide approximately 900 megawatts (MW) of capacity, and produce about 4,600 gigawatt hours (GWh) of electricity each year — enough electricity to power approximately 410,000 homes.

If constructed, Site C would be publicly owned and would have a significant capital cost and low long-term operating costs. Site C would be a clean and renewable source of firm and dependable electricity for over 100 years.¹

¹ The *BC Energy Plan* defines clean or renewable electricity generation as sources of energy that are constantly renewed by natural processes, such as large and small hydroelectric, solar, wind, tidal, geothermal, wood residue, and energy from organic municipal waste.

FIGURE 1-2: HISTORIC CONCEPTUAL DESIGN OF THE SITE C HYDROELECTRIC FACILITY



1.1.2 HISTORY OF THE PROJECT

The history of the Site C project dates back to the late 1950s when it was first identified as a potential third dam on the Peace River.²

The project was later examined as a resource option in the late 1970s, which culminated in an application to the provincial government for an Energy Project Certificate in 1980. In 1981, the government referred the application to the British Columbia Utilities Commission (BCUC) for review. In 1983, the BCUC concluded that Site C was an acceptable project, but indicated that more work was required around the future demand for electricity and alternatives to the project. The BCUC wrote:

In sum, while the Commission recognizes that major impacts will result from the Site C project, the Commission concludes that they are not so large as to make them unacceptable. Provided that appropriate conditions are placed on Hydro and that the government responds to the special needs created in the region, the impacts can be successfully and acceptably managed.

The BCUC concluded that:

An Energy Project Certificate for Site C should not be issued until (1) an acceptable forecast demonstrates that construction must begin immediately in order to avoid supply deficiencies and (2) a comparison of alternative feasible system plans demonstrates...that Site C is the best project to meet the anticipated supply deficiency.



Opening ceremony of the W.A.C. Bennett Dam, 1968.

A NEW APPROACH

Should the Site C project advance to Stage 3, today's approach would consider potential environmental and socio-economic effects, impacts to land, and opportunities for community benefits. In addition, the next stage would include further engineering, technical and financial work, as well as consultation with First Nations, the public, communities, property owners and stakeholders.

Between 1989 and 1991, Site C was again looked at as a potential supply option for the future, but work was suspended in favour of demand-side management and gas-fired generation.

In subsequent years, British Columbia's electricity needs continued to grow, along with its economy and population. In the early 2000s, it became apparent that new dependable sources of electricity would be required to meet future demand.

In 2004, as part of BC Hydro's Integrated Electricity Plan (2004 IEP), Site C was identified as a potential resource option for the future. The IEP recommended conducting studies and initiating discussions with First Nations and stakeholders. Two years later, Site C was again included in BC Hydro's 2006 IEP as one of the potential resources that could help address the province's electricity needs in the next 20 years and recommended further review.

In February 2007, the provincial government's *BC Energy Plan* listed Site C as a potential resource option to help meet B.C.'s future electricity needs and directed BC Hydro and the provincial government to begin discussions with communities, First Nations, the Province of Alberta and the Northwest Territories.

² For a more in-depth description of the history of Site C since the 1950s, see Chapter 3 of the *Site C Feasibility Review: Stage 1 Completion Report*, December 2007.

1.1.3 AN OPTION TO HELP MEET B.C.'S GROWING ELECTRICITY NEEDS

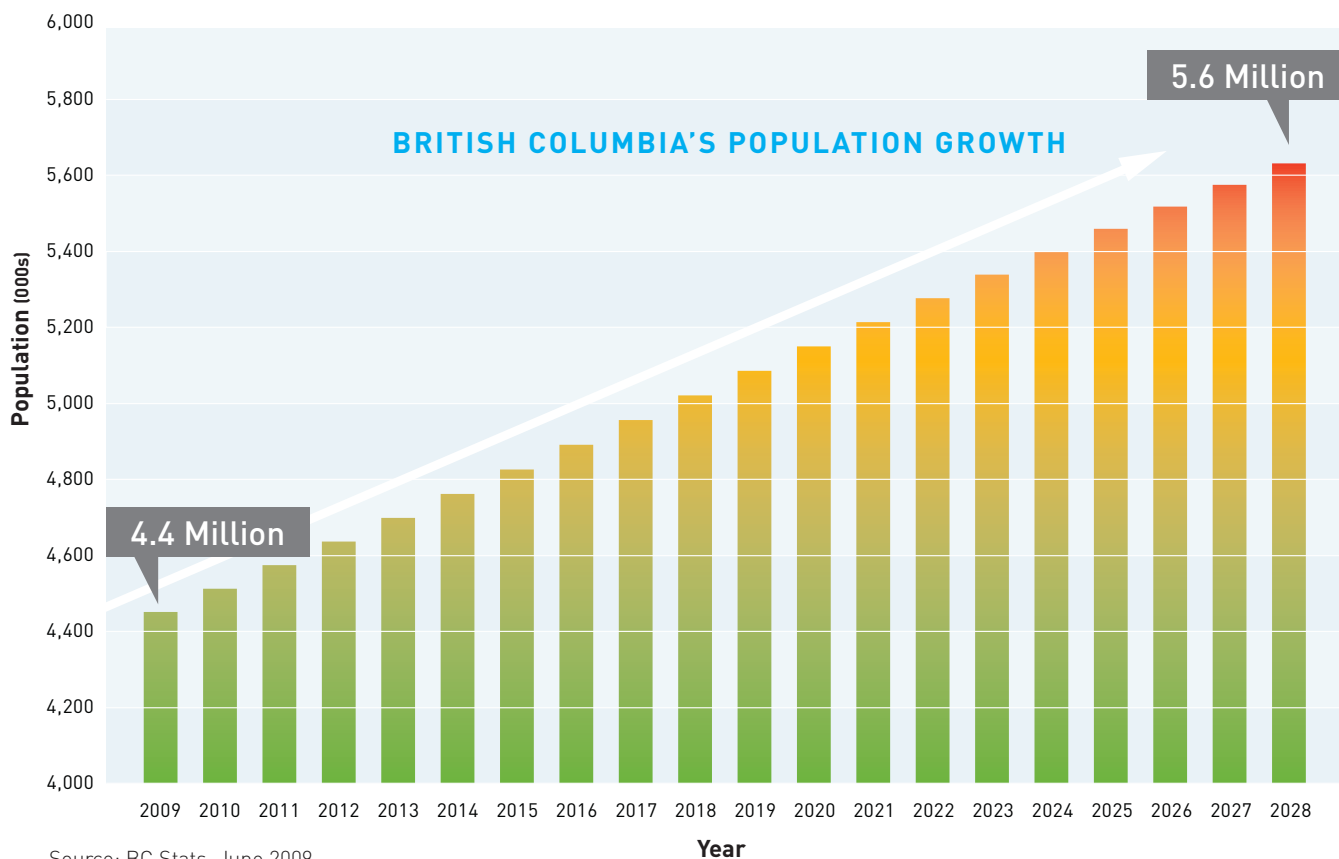
BC Hydro's current load forecast indicates that B.C.'s electricity requirements will grow by 20 to 40 per cent over the next 20 years. As extensive as BC Hydro's hydroelectric assets are, they will not be enough to provide future generations of British Columbians with electricity self-sufficiency if demand continues to grow as projected.

BC Hydro is planning now so that British Columbians will continue to enjoy the benefits of a secure, reliable and affordable electricity supply. As part of its responsibility to meet the province's electricity demand in the future, BC Hydro is pursuing a variety of options — consistent with the policy direction set out in the *BC Energy Plan* (see topic box on page 12). In particular, demand will be met by conserving more electricity, by buying more electricity from renewable power projects — such as wind and run-of-river hydro — and by building more through reinvestments in existing assets and considering new resource options, such as Site C.

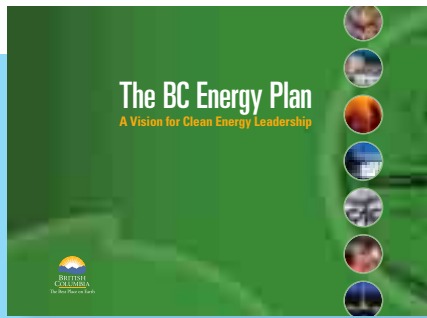
Although there may be short-term fluctuations in supply and demand, the long-term trend is very clear: B.C.'s electricity needs will continue to grow significantly. In 20 years, B.C.'s population is forecast to increase by more than one million residents (see Figure 1-3), and additional clean and renewable electricity will be required to meet provincial climate action objectives. That means BC Hydro needs to find new clean electricity sources to serve this population growth and the economic activity it will generate.

Large projects like Site C require a long lead time — 10 years or more — and require early evaluation and study. Sufficient early work must be completed to maintain the option to build a large hydroelectric project to meet future electricity needs.

FIGURE 1-3: BRITISH COLUMBIA'S PROJECTED POPULATION GROWTH 2009 – 2028



Source: BC Stats, June 2009.



BC ENERGY PLAN: A Vision for Clean Energy Leadership

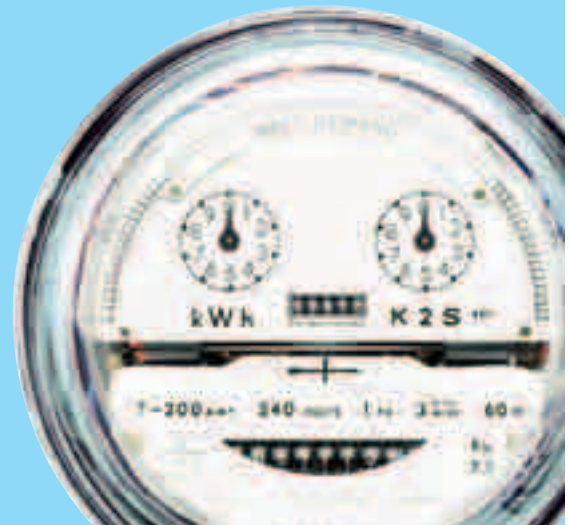
BC Hydro's actions to ensure our province can meet its future electricity needs are guided by the provincial government's 2007 *BC Energy Plan*. The *BC Energy Plan* directed BC Hydro and the provincial government to "enter into initial discussions with First Nations, the Province of Alberta and communities to discuss Site C to ensure that communications regarding the potential project and the processes being followed are well known."

The plan also set targets to make the province electricity self-sufficient, while charting a path for conservation, energy efficiency and clean energy. The policy initiatives listed below are relevant to the Site C project:

- Ensure self-sufficiency to meet electricity needs by 2016, plus "insurance" power to supply unexpected demand thereafter.
- All new electricity generating facilities constructed in B.C. will be required to achieve zero net greenhouse gas emissions.
- By 2016, existing thermal generating power plants will achieve zero net greenhouse gas emissions.
- Require zero greenhouse gas emissions from any coal thermal electricity facilities.
- No nuclear power.

- Ensure clean and renewable electricity generation, including large and small hydroelectric, solar, wind, tidal, geothermal, wood residue and energy from organic municipal waste, continues to account for at least 90 per cent of total generation.
- Acquire at least 50 per cent of BC Hydro's incremental resource needs through conservation by 2020.
- Maintain our competitive electricity rate advantage.
- Maintain public ownership of BC Hydro.

The *BC Energy Plan: A Vision for Clean Energy Leadership* is available online at www.energyplan.gov.bc.ca.



1.2 PURPOSE

The overall purpose of Stage 2 work was to:

- Conduct consultations with First Nations, the public, property owners, stakeholders and communities and have discussions with the Province of Alberta and the Northwest Territories, as directed by the *BC Energy Plan*.
- Update and undertake further analysis of key engineering and technical issues.
- Conduct environmental and socio-economic baseline studies to better understand current conditions around the potential Site C project.



Maintenance and upgrading work on an electric generator at Peace Canyon generating station near Hudson's Hope (July 2009).



Peace River, looking downstream from Hudson's Hope (July 2009).

1.3 SCOPE

Given the long lead time and the scope of the evaluation and development work, and in keeping with best practices for large capital projects, BC Hydro adopted a multi-stage approach for the potential Site C project.

A multi-stage approach was selected to ensure due diligence in project planning. The multi-stage approach provides for an informed decision-making process by allocating multiple milestones for assessing the project and deciding whether to proceed to the next stage.

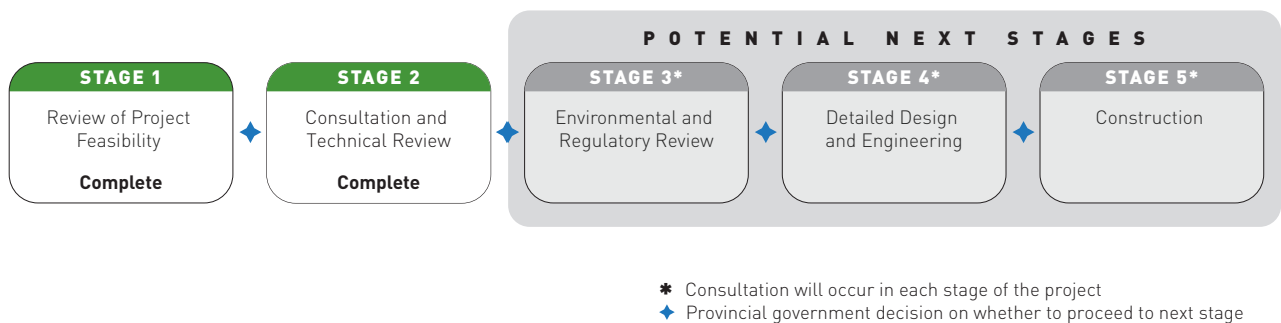
As part of the multi-stage process, BC Hydro makes a recommendation to the provincial government at the completion of each stage as to whether the project should proceed to the next stage. The provincial government then reviews the recommendation and makes a decision on whether to proceed, cancel or defer further work on the project.

Stage 1 concluded with the release of the *Site C Feasibility Review: Stage 1 Completion Report* in 2007. During this initial stage, existing studies and historical information related to engineering, costs, environment and land, consultation and First Nations were reviewed. At the completion of Stage 1, BC Hydro determined that the project was still feasible and recommended to the provincial government that it move forward to the next stage.

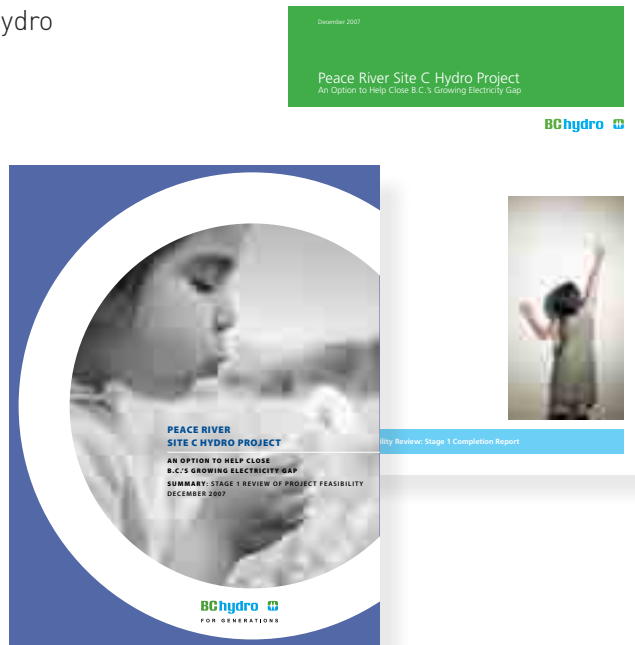
Stage 2 commenced in the fall of 2007. Activities during this stage included extensive consultations with the public, stakeholders, communities, Aboriginal groups and property owners, as well as early discussions with the Province of Alberta and the Northwest Territories. This stage also included the initiation of field studies to better understand current conditions related to the physical, biological and socio-economic environment, and to gather engineering and technical information regarding the design, construction and operation of the potential project.

BC Hydro's Stage 2 work, including its purpose, scope and key findings, is described in Chapters 2 through 8 of this report.

FIGURE 1-4: MULTI-STAGE EVALUATION, PLANNING AND DEVELOPMENT



Studies and reports used to compile this Stage 2 report are listed at the end of each chapter and are available on the BC Hydro website (www.bchydro.com/sitec).



Dinosaur Reservoir, upstream of Peace Canyon Dam (September 2009).

2.0 B.C.'S LONG-TERM ELECTRICITY NEEDS

CHAPTER HIGHLIGHTS

- The province's electricity needs are forecast to grow by 20 to 40 per cent over the next 20 years.
- As extensive as BC Hydro's hydroelectric assets are, they will not be enough to provide future generations of British Columbians with electricity self-sufficiency if demand continues to grow as projected.
- BC Hydro's Long-Term Acquisition Plan (LTAP) indicates that Site C is an attractive resource option to reliably meet the growing demand for electricity in B.C.
- Key characteristics of the potential Site C project include:
 - Site C would deliver firm, reliable energy and capacity that would be highly flexible to adjust to changes in resources or loads.
 - Energy would be available during both daily and annual peak periods.
 - As the third project on one river system, Site C would optimize upstream storage and regulation by taking advantage of water already stored in the Williston Reservoir.
 - Site C would have low greenhouse gas (GHG) emissions, per gigawatt hour, compared to other electricity supply options.
 - Electricity generated at Site C would be unaffected by fluctuations in natural gas costs and carbon pricing that could affect other forms of energy supply.

This chapter describes BC Hydro's long-term planning process to meet future electricity needs in the province while continuing to be a leader in the production and supply of low-cost, clean and renewable electricity.

2.1 BACKGROUND

BC Hydro is a leader in the development of clean electricity generation and a facilitator of the economic development of the province. This leadership requires a combination of actions, including a continued emphasis on cost-effective operations and a focus on the reliability and resiliency of the BC Hydro network. At the same time, BC Hydro continues to build awareness of the need to use less electricity, and to use it more efficiently, through Power Smart programs and new Demand-Side Management (DSM) initiatives.

BC Hydro's 2008 Long-Term Acquisition Plan (LTAP) details the framework, resources and measures that BC Hydro plans to use to meet its future electricity needs. By comparing the anticipated future demand for electricity with existing and committed resources, BC Hydro is able to determine the forecasted supply-demand gap and make plans to close it through a combination of conservation programs and new supply-side resource options.

The 2008 LTAP incorporated significant policy and legislative changes, including the provincial government's 2007 *BC Energy Plan* and 2008 amendments to the *Utilities Commission Act*. This ambitious new direction in public policy calls upon BC Hydro to acquire at least 50 per cent of its incremental resource needs through conservation and efficiency measures by 2020.

BCUC DECISION ON THE 2008 LTAP

In July 2009, the British Columbia Utilities Commission (BCUC) accepted BC Hydro's load forecast. However, the BCUC rejected BC Hydro's 2008 LTAP and asked BC Hydro to submit a new LTAP.

While the BCUC did not approve the plan in its entirety, it did approve \$631 million out of \$633 million in requested expenditures, including \$418 million for BC Hydro's conservation programs and \$41 million for Stage 2 funding of the Site C project.

The *BC Energy Plan* also provides direction on the resource options available and not available (e.g., no nuclear, zero GHG emissions from coal) to BC Hydro, while reinforcing a commitment to maintain B.C.'s competitive electricity rate advantage.

While using less electricity and using it wisely through conservation and energy efficiency is the first and best choice to meet future electricity needs, it will not be enough should demand continue to grow as projected. New electricity resources — both large and small — must be considered. The potential Site C project is one of the resources being considered to help meet B.C.'s future electricity needs.



Peace Canyon Dam.

B.C.'S EMERGING TRENDS

In addition to BC Hydro's LTAP, there are a number of emerging issues in British Columbia that are important to consider in the review of Site C.

DEMAND TRENDS

The provincial government has legislated a 33 per cent reduction in greenhouse gas (GHG) emissions by 2020. In addition, the provincial government has set a goal of reducing the carbon intensity of all passenger vehicles in B.C. by 10 per cent by 2020.

In meeting these provincial goals, the February 2009 Throne Speech noted that electric plug-in vehicles and other technologies aimed at reducing fossil fuel dependency may eventually place new demands on our electricity system.

BC Hydro is monitoring potential new demands that may result from future GHG-related legislation, regulations and policy, new technologies, and demographic trends. In addition, BC Hydro is researching potential increases in demand from the electrification of the transportation sector (including rail, ports and electric plug-in vehicles) and fuel switching (e.g., residential space and water heating). These prospective loads were not included in the 2008 LTAP. However, they have been considered as scenarios for study and potential inclusion in future demand forecasts, when they become more visible and quantifiable.

SUPPLY TRENDS

In the 2008 LTAP, BC Hydro undertook a targeted update of the supply-side resource options reviewed in its 2005 Resource Options Report. The characteristics for distributed generation were not included in the targeted update, as they are not yet commercially available. However, BC Hydro will be updating them in its next LTAP. Distributed generation is an approach whereby smaller-scale generation of electricity is located close to the demand it is intended to serve — often at customer sites or involving customers.

Distributed generation may result in avoided transmission costs and additional system supply. For customers, it can provide energy independence, new choices, additional sources of revenue, and enhanced power reliability and quality.

On a provincial scale, distributed generation may contribute to self-sufficiency, encourage diversity in local industries, and promote a sustainable electricity future for B.C.

Distributed generation has a variable reliability depending on the resource type used for generation. For planning purposes, wind and small-scale solar applications would likely be intermittent resources and would require additional backup generation to meet system peak demand requirements. BC Hydro is in the final stages of developing its distributed generation strategy.

EMERGING TRENDS AND SITE C

B.C.'s emerging trends indicate some key uncertainties with respect to both demand and supply that further reinforce the advantages of maintaining Site C as a resource option. They include:

- An increase in demand would mean that more resources will be required to meet future electricity needs.
- An increase in intermittent distributed generation would require dependable, flexible backup generation sources.

Site C's unique characteristics of high energy capability, high peak capacity and high flexibility make it an attractive potential resource option to meet these needs, should they materialize.



2.2 PURPOSE

During Stage 2, BC Hydro primarily used the 2008 LTAP to evaluate how Site C and other supply-side and demand-side alternatives can help meet B.C.'s long-term electricity needs.

2.3 SCOPE

As part of BC Hydro's responsibility to ensure the province's electricity supply for the future, a variety of options were looked at in the 2008 LTAP to help meet future electricity demand, including the potential Site C project, wind, run-of-river hydro, natural gas, geothermal, biomass and, most importantly, conservation.

Forecasting B.C.'s future electricity needs is not without challenges. Many variables and uncertainties are at play, including the continuing impacts of climate change, water levels, customer behaviour, technological shifts (such as electric vehicles), global energy markets and economic trends. As a result, BC Hydro produces an annual update of its energy and peak load needs over the next 20 years.

The multi-stage decision-making process for reviewing Site C allows the most current forecasts and emerging issues to be considered at each stage.

2.3.1 2008 LTAP SITE C PORTFOLIO ANALYSIS

Based on the original project design, Site C would provide 900 MW of flexible, dependable capacity and generate, on average, 4,600 GWh of electricity annually. In the 2008 LTAP, BC Hydro examined a range of demand and thermal generation cost scenarios (including gas and electricity price and GHG-offset cost scenarios), both with and without Site C. By comparing the results, BC Hydro was able to assess the attractiveness of this potential resource in terms of its physical attributes and its cost, and in terms of providing a backup should not all of the actions that BC Hydro has included in its resource plans materialize.



Nightscape in Fort St. John (July 2009).

2.4 KEY FINDINGS

2.4.1 B.C.'S GROWING ELECTRICITY NEEDS

Regardless of potential short-term shifts in supply and demand, the long-term trend is clear: B.C.'s future electricity needs will continue to grow significantly. The province's electricity needs are forecast to grow by 20 to 40 per cent over the next 20 years. As extensive as BC Hydro's hydroelectric assets are, they will not be enough to provide future generations of British Columbians with electricity self-sufficiency if demand continues to grow as projected.

Without BC Hydro's conservation initiatives and other long-term planning actions, B.C.'s electricity shortfall in 20 years is expected to be approximately 25,800 gigawatt hours per year (GWh/yr.). This is based on the latest demand-supply outlook – a gap that is about half of all the electricity (approximately 55,400 GWh/yr.) that is required to serve BC Hydro customers today.

2.4.2 MEETING FUTURE SUPPLY NEEDS

To meet our future electricity needs, BC Hydro's long-term plan is based on conserving more, buying more renewable power — such as wind and run-of-river hydro — and building more supply by reinvesting in existing assets and considering new reliable resources such as Site C. Even though BC Hydro is aiming to meet more than half of B.C.'s future incremental electricity needs with conservation, BC Hydro must still consider other made-in-B.C. resource options to meet the balance of our requirements and achieve electricity self-sufficiency.

2.4.2.1 CONSERVATION

As BC Hydro's first and best choice for managing the future supply gap, conservation efforts are focused on codes and standards, rate structures, programs and supporting initiatives that promote behavioural change, as well as energy efficiency. More than 50 per cent of BC Hydro's incremental resource needs through 2021 are forecast to be met through conservation, with a target of 9,900 GWh of savings.

The codes and standards component includes changes to energy-efficiency regulations that have been enacted or announced or are planned by the federal and provincial governments. This includes efficiency improvements to electronic equipment, incandescent lighting, other residential equipment (e.g., air conditioners), building codes, appliances, motors and commercial equipment (e.g., streetlights).

BC Hydro's conservation programs are designed to provide incentives for saving electricity, while developing an energy conservation and efficiency culture in B.C.



BChydro 
powersmart

2.4.2.2 PURCHASES FROM INDEPENDENT POWER PRODUCERS

BC Hydro's existing contracts³ with independent power producers (IPPs) represent approximately 8,700 GWh of annual firm energy and 750 MW of dependable capacity in 2021. This includes existing projects that are in service and those that are still under development but for which BC Hydro signed electricity purchase agreements between 1989 and 2009. The estimated contribution from projects that are still under development includes an adjustment for attrition, based on previous experience.⁴ The Bioenergy Call is guided by the policy actions contained in the 2007 *BC Energy Plan*. In December 2008, BC Hydro selected four proposals in the Phase I Request for Proposals for a total of approximately 500 GWh and 50 MW after expected attrition. The expected contribution from the Phase II Request for Proposals is approximately 700 GWh and 100 MW after expected attrition.⁵ BC Hydro issued a Clean Power Call Request for Proposals in June 2008. Bidders have been short-listed and detailed negotiations are underway.



Ashlu Creek.



Wind farm near Dawson Creek.

³ Including pre-2000 electricity purchase agreements, the 2000 Green Request for Expressions of Interest, the 2001 Green Energy Call, the 2002 Customer-Based Generation Call, the 2003 Green Power Generation Call, the F2006 Call for Tenders, the 2008 Standing Offer Program and the Bioenergy Call Phase I.

⁴ When determining an appropriate target volume of energy for an acquisition process, BC Hydro must consider the possibility that some of the awarded electricity purchase agreements may not proceed. In the 2008 LTAP, BC Hydro used an attrition allowance of 30 per cent.

⁵ The values provided for the Bioenergy Calls are the maximum annual commitment after attrition.

2.4.2.3 BC HYDRO HERITAGE ASSETS

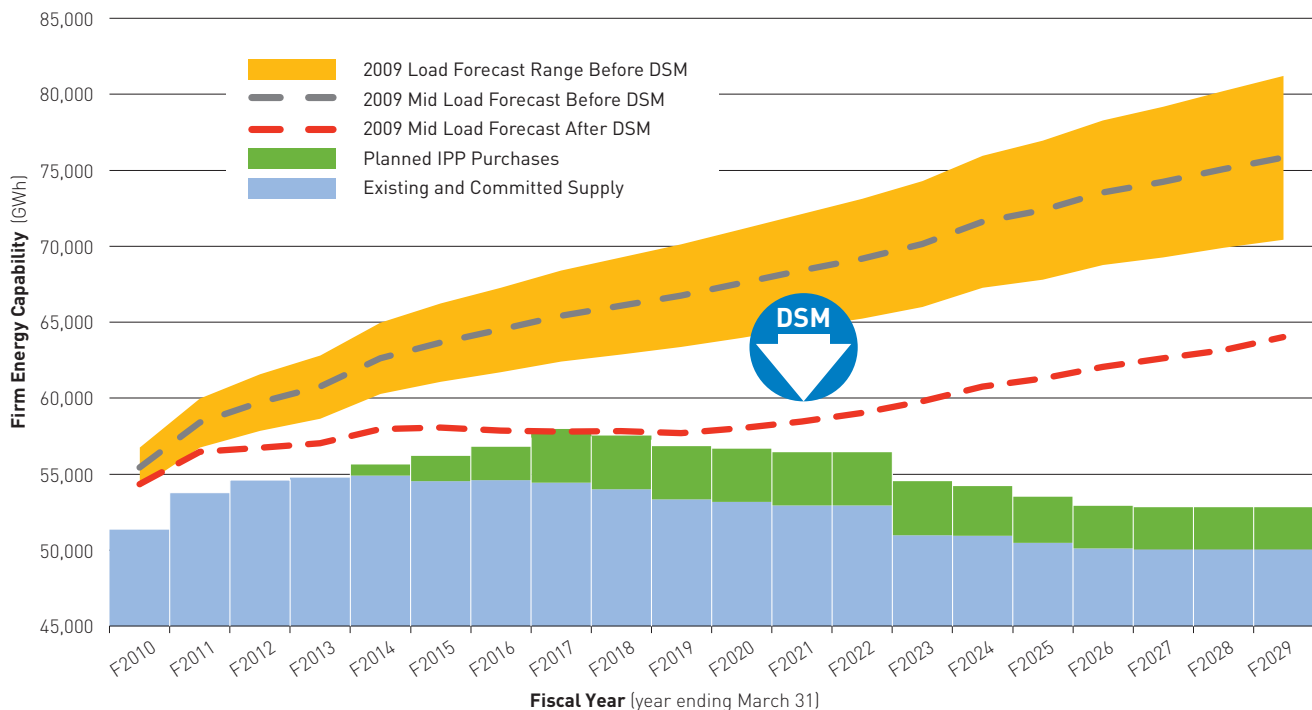
BC Hydro continues to make important investments to modernize, optimize, expand the capacity, and extend the life of its existing assets. These investments will ensure that the backbone of the BC Hydro system remains strong and reliable in the future and include:

- **Heritage Hydroelectric Assets:** BC Hydro's existing hydroelectric facilities are capable of providing 42,600 GWh of firm energy and 9,700 MW of dependable capacity each year.
- **Heritage Thermal Assets:** Burrard Thermal Generating Station is BC Hydro's main natural-gas-fired thermal generating facility. It provides transmission support and electrical supply security for the load centre by playing a backup role in times of low inflow and system outages during peak loads. As part of its commitment to reduce greenhouse gases and become a clean energy powerhouse, the provincial government issued Direction No. 2 to the BCUC on October 28, 2009, ordering that Burrard Thermal will no longer be used for planning purposes for firm energy, and will only be used for up to 900 MW of emergency capacity.

- **Investment in Heritage Assets:** BC Hydro's Resource Smart program, introduced in the late 1980s, promotes the investment in existing BC Hydro facilities to provide cost-effective energy and capacity gains to the system. Examples of Resource Smart projects are generator and turbine upgrades that increase output and improve efficiency. Investments at Aberfeldie, G.M. Shrum, John Hart and Cheakamus are included as supply in the 2008 LTAP. The expected contribution of these improvements is approximately 500 GWh/yr. of firm energy and 150 MW of new dependable capacity by 2017.
- In July 2007, the BCUC issued a Certificate of Public Convenience and Necessity (CPCN) for BC Hydro's proposal to build a fifth generating unit at Revelstoke. This project will be capable of providing approximately 100 GWh/yr. of firm energy and 500 MW of incremental dependable capacity to the system. There are three further potential units at Revelstoke and Mica that could provide an additional 1,400 MW of winter-dependable capacity with some additional firm energy.

Figure 2-1 shows BC Hydro's long-term load forecast and resource balance after conservation and purchases from IPPs.

FIGURE 2-1: ENERGY LOAD/RESOURCE BALANCE AFTER CONSERVATION AND IPP PURCHASES



This figure is based on the load resource information as of October 2009. The blue bar of Existing and Committed Supply reflects the B.C. government's order of October 28, 2009 reducing reliance on Burrard Thermal for firm energy, the latest EPA replacements/amendments, and the Waneta Transaction. The green bar of Planned IPP Purchases includes Clean Power Call and Bioenergy Call Phase II as filed in the 2008 LTAP. The insurance requirement has not been reflected in this figure.

ENERGY AND CAPACITY

One of the distinguishing features of Site C is its high quality of both energy and generating capacity. The following paragraphs define these terms and demonstrate how a resource with these characteristics can add value to the BC Hydro system.

Energy refers to the total amount of annual electricity that a utility or resource provides.

Capacity is the highest level of electricity that a utility or resource can reliably supply at the point of maximum usage by utility customers (in the BC Hydro system, this is typically the dinner hour on the coldest day of winter). If we use a garden hose as a metaphor for a generation facility, capacity is the rate of flow of water out of the hose, while energy is the amount of water that is released.

ENERGY: For the BC Hydro system, energy is measured in kilowatt hours (kWh), and typically averages about 11,000 kWh per year per household. The energy supplied to all BC Hydro customers is measured in gigawatt hours (GWh) – each GWh is equivalent to one million kWh. For 2009, the annual energy required to serve BC Hydro customers was approximately 55,400 GWh.

Different types of generation resources have variable levels of ability to deliver energy. One important measure of variability is the amount that a project's annual generation varies from year to year. This is an important consideration with hydroelectric generation, as the amount of energy is dependent on the level of snow and rain, which can vary significantly from year to year. The amount of energy that can be counted on from a hydro system in the worst year of water supply on record is generally referred to as "firm energy".

Another important component of energy variability is the seasonal profile of available energy. For example, some run-of-river hydro resources in the interior of B.C. may get most of their water during the spring runoff as the snow melts, while others on the coast have their highest output in the winter. Because there is no reservoir to store the water at these projects, they must generate energy the instant the water comes in. While run-of-river and other intermittent resources provide energy to the BC Hydro system, the timing of that energy is a key consideration in BC Hydro's procurement processes.

One advantage of large hydro is that, instead of immediately generating electricity, the spring runoff water can be stored and used in winter when demand is high. This is how BC Hydro can meet customer demand with a generating system that is comprised of more than 90 per cent hydro.

CAPACITY: Capacity is generally measured in megawatts. All resources have an installed generation capability, but this is not always equal to their reliable capacity. Some generation resources have an intermittent fuel source (e.g., wind power, solar and run-of-river hydro), which means they may not be available at times of peak demand. As a result, BC Hydro must plan additional backup generating capacity (e.g., large hydro, natural gas, biomass, geothermal) to ensure that it can serve customer demand in case the intermittent resources are not available.

2.4.3 RESOURCE ALTERNATIVES

In order to meet the expected demand, BC Hydro uses economic portfolio analysis to select resource alternatives, including Site C, based on the following key characteristics: resource availability, volume and quality of incremental energy and capacity, location, environmental and social impacts, price and development lead time.⁶

- **Resource Availability:** The approximate availability of various resources was evaluated in the 2008 LTAP Resource Options Update. All supply-side options are consistent with B.C. government policy and related legislative initiatives, which means that only those located in B.C. are examined.
- **Volume and Quality of Incremental Energy and Capacity:** Resources can be relied upon in multiple ways. Some can reliably deliver an amount of electricity over a given time period (e.g., one year), some can reliably deliver power at specific times during the year, and some can do both. In evaluating whether a resource can meet BC Hydro's electricity requirements, a delivery profile that is similar to BC Hydro's typical demand profile is advantageous. For example, generation from hydroelectric resources with storage can be shaped to match BC Hydro's seasonal electricity demand requirements. However, intermittent resources, such as run-of-river hydro with no storage, need to be integrated with dependable, flexible generation. In the BC Hydro system, this dependable, flexible generation is currently provided by large hydro with storage capability. Resources that are able to provide a consistent source of electricity during BC Hydro's peak load in the winter are ideal.

As with the annual profile, it is important to consider whether a resource will be available to deliver during peak demand times of the day: in the late afternoon and early evening.

The ability for resources to be both reliable and flexible to match BC Hydro's requirements during different times of the day and year is very valuable.

- **Location:** Many of the potential supply-side resources are located outside of the Lower Mainland and Vancouver Island regions. The existing and planned resources in a particular region, the need in that region, and the need to move excess power to the main demand centres are evaluated by the British Columbia Transmission Corporation (BCTC) on a portfolio basis to determine required incremental transmission investments.
- **Environmental and Social Impacts:** Consistent with greenhouse gas (GHG) policy, a GHG offset cost was the only environmental impact that was translated into a potential future financial obligation in the 2008 LTAP. Other environmental and social effects were considered as part of the qualitative analysis of the resource options (see Table 2-2).
- **Price:** Price is a critical input into the models used to evaluate resource options. It should be noted that scenarios with Site C available as a resource option in the 2008 LTAP also include pricing alternatives for four different risk reserves.⁷ No other resource options in the 2008 LTAP include a corresponding risk reserve.
- **Development Lead Time:** BC Hydro must consider the time required for each option to be built and permitted in order to make sure that the option is ready to deliver when it is required to meet customer demand. In some cases, the development lead time for the associated transmission requirements for a given portfolio of resources is more critical than the development time for the generation.

The evaluation of the potential Site C project in relation to other energy options such as run-of-river hydro, wind, solar, geothermal and biomass continues to be an important topic of interest for the public, stakeholders and First Nations. BC Hydro's planning process includes a comparison of resource options.

Table 2-1 shows the physical characteristics of the resource options. These are characteristics associated with capacity, energy and reliability. Figure 2-2 outlines the variation in price of the various resource options.

Table 2-2 shows the environmental characteristics and financial risks that BC Hydro takes into account when evaluating resource options.

⁶ Additional qualitative analysis is used to evaluate non-price factors such as environmental and social effects that have not been translated into financial obligations. These can shed light on the incremental risk of a plan of resources and the degree to which it will be accepted by communities and First Nations, and the likelihood of regulatory approvals.

⁷ A risk reserve is included to reflect risks not considered adequately covered by normal project contingencies.

SUPPORTING THE DEVELOPMENT OF RENEWABLE RESOURCES

B.C.'s future energy needs will require clean and renewable resources, such as wind, run-of-river hydro and solar. However, as shown in Table 2-1, many renewable resources are intermittent, meaning they are not always available, to generate electricity (e.g., when the wind is not blowing, the river is not flowing, or the sun is not shining). To facilitate the development of renewables, there is also a need for dependable and flexible resources.

A dependable resource — such as large hydro, biomass, geothermal and natural gas — is consistently available to meet winter peak demand. A flexible resource — such as large hydro and some natural gas — is able to quickly adjust its generation level in response to changes in demand or intermittent generation.

As more intermittent resources are added to the BC Hydro system, it is necessary to back them up with dependable generation, and it is ideal to back them up with dependable, flexible generation to match their variability.

An advantage of large hydro, such as the Site C project, is that in addition to being dependable, these projects are flexible and generation can be increased or decreased in response to instantaneous changes in demand or intermittent generation. For example, the generation from large hydro can be reduced when intermittent resources are available and the additional water can be stored in the reservoir for later use. When intermittent resources are not available, the generation from large hydro can be increased to make sure British Columbians have the energy they require.

As a source of dependable and flexible energy, Site C would support the development of renewable resources in B.C. by providing a reliable backup to those renewable resources that are intermittent, such as wind, run-of-river hydro and solar.



Wind turbine.



The Pingston run-of-river small hydro plant, south of Revelstoke.

TABLE 2-1: B.C. RESOURCE OPTIONS – VOLUME AND QUALITY OF ENERGY

RESOURCE OPTION	CAPACITY (Per Cent Peak)	ENERGY (Per Cent Firm)	RELIABILITY
Conservation	n/a	n/a	n/a
Biomass	100%	100%	Dependable
Small Hydro (run-of-river)	13%	71%	Intermittent
Large Hydro (Site C)	100%	87%	Dependable (flexible)
Geothermal	100%	100%	Dependable
Wind	21%	100%	Intermittent
Natural Gas	100%	100%	Dependable (can be flexible)
Wave/Tidal	5%	No data	Intermittent
Distributed Generation (small-scale wind/solar)	0%	No data	Varies
Coal (zero GHGs)	100%	100%	Dependable
Large-Scale Solar	No data	No data	Intermittent

The four resource options shown in blue were not updated in the 2008 LTAP, as at that time, these options were considered either uneconomic or not commercially available on a large scale. Data for wave/tidal, distributed generation and coal options are based on the 2006 IEP/LTAP.

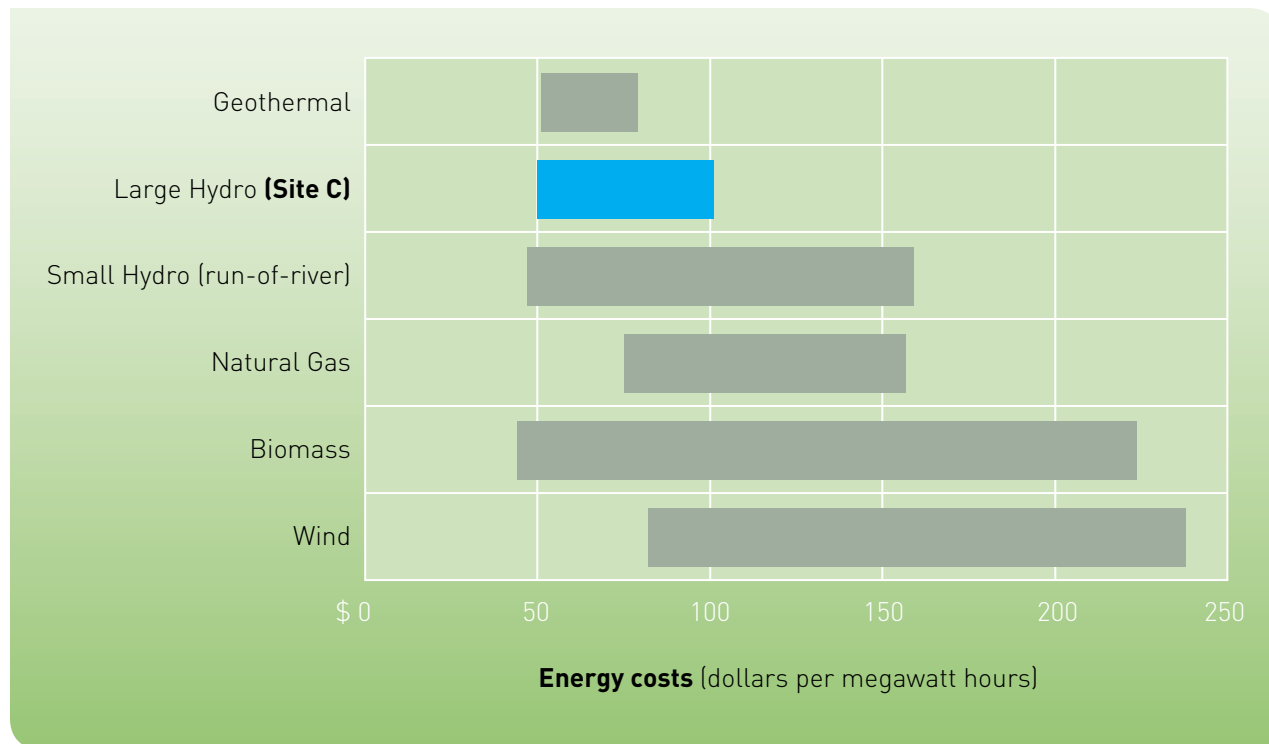


Large-scale solar panels.



Trees killed by pine beetles can be used for biomass.

FIGURE 2-2: SELECTED ENERGY SUPPLY OPTIONS – ADJUSTED UNIT ENERGY COST (UEC)



The cost information above is based on the resource options update prepared for the 2008 LTAP and is meant to indicate the relative costs of supply options. Updated information on costs will be available in the next LTAP. Actual costs of supply options are only available when supply or construction contracts have been signed.



Conservation.



Turbine at Race Rocks Tidal Energy Project (2006).

TABLE 2-2: B.C. RESOURCE OPTIONS – RELATIVE FINANCIAL AND ENVIRONMENTAL ATTRIBUTES

RESOURCE TYPE	FINANCIAL COST (Cost Drivers)	ENVIRONMENTAL AND SOCIAL IMPACTS		
		AIR	LAND	WATER
Conservation (demand-side management)	<ul style="list-style-type: none"> • Low operating cost • No fuel cost • Can require large initial capital investment 	Negligible	Negligible	Negligible
Biomass	<ul style="list-style-type: none"> • Low operating cost • Low fuel cost • Large initial capital investment 	<p>Dependent upon fuel burned; possible local air impacts.</p> <p>Electricity generated from biogas and wood waste is considered to have net zero GHGs.</p> <p>GHG emissions from municipal solid waste must be offset.</p> <p>GHG emissions from transportation.</p>	Land impacts due to facility footprint, access roads, transmission rights-of-way and fuel harvest impacts.	Consumptive water use.
Small Hydro (run-of-river)	<ul style="list-style-type: none"> • Low operating cost • No fuel cost (water rentals) • Large initial capital investment 	<p>Potential short-term construction-related impacts from dust.</p> <p>Short-term construction-related GHG impacts from vehicle and equipment use.</p>	Affects wildlife habitat, traditional and recreational uses due to construction, access roads and transmission rights-of-way.	<p>Diverts a portion of stream flow.</p> <p>May affect fish, habitat and recreational uses.</p> <p>Generally high gradient streams.</p>
Large Hydro (Site C)	<ul style="list-style-type: none"> • Low operating cost • No fuel cost (water rentals) • Large initial capital investment 	<p>Possible localized climatic changes (e.g., fog).</p> <p>Some GHG emissions related to reservoir development and construction, but minimal in relation to the energy produced over the life of the project.</p>	<p>Affects wildlife, traditional and recreational land use, agriculture, forestry.</p> <p>Project would expand cleared width along existing transmission right-of-way.</p>	Changes aquatic environment and species from riverine to reservoir setting. May affect flows immediately downstream of dam.
Geothermal (conventional)	<ul style="list-style-type: none"> • Moderate operating cost • No fuel cost • Large initial capital investment 	Some GHG emissions during construction. Some sites may have minimal GHG emissions during operations.	Negligible land requirements for site, land required for transmission and access roads.	Potential impacts on groundwater flow, but minimal impacts on water quality.
Wind	<ul style="list-style-type: none"> • Low operating cost • No fuel cost • Large initial capital investment 	Primarily construction-related impact.	<p>Visual impact of towers; typically located on ridges or coast.</p> <p>Land impacts due to access roads and transmission right-of-way.</p>	Potential visual impacts as well as impacts on the ocean floor, mammals, birds and fisheries at offshore sites.

RESOURCE TYPE	FINANCIAL COST (Cost Drivers)	ENVIRONMENTAL AND SOCIAL IMPACTS		
		AIR	LAND	WATER
Natural Gas⁸	<ul style="list-style-type: none"> • Low operating cost • Significant fuel cost • Moderate capital investment 	Local air emissions (such as nitrous oxide emissions) are largely controllable. GHG emissions must be offset.	Land impacts limited to facility, access and transmission right-of-way footprint.	Consumptive water use.
Wave/Tidal	<ul style="list-style-type: none"> • Moderate operating cost • No fuel cost • Large initial capital investment 	Limited to construction-related emissions.	Land impacts due to facility footprint, access routes and transmission right-of-way.	May have an impact on local tide and current regime. Possible impact on fish or mammal migrations.
Distributed Generation (small-scale wind/solar)⁹	<ul style="list-style-type: none"> • Variable initial capital investment 	Limited to construction-related emissions. Microturbines may have GHG emissions.	Low – generally implemented on existing site.	Negligible
Coal (carbon sequestered)	<ul style="list-style-type: none"> • Even split between fuel cost (coal) and service on capital 	Some sulphur oxide or mercury emissions. Other local air impacts are largely controllable. GHG emissions must be captured and sequestered on-site.	Land impacts from facility footprint as well as mine, transportation infrastructure and transmission right-of-way.	Consumptive water use and water quality impacts.
Large-scale Solar	<ul style="list-style-type: none"> • Low operating cost • No fuel cost • Large initial capital investment 	Limited to potential release of particulates during construction. Short-term construction-related impacts from vehicle and equipment use.	Land impacts due to facility footprint, access routes and transmission right-of-way.	Consumptive water use for some designs.

Based on the information in Tables 2-1 and 2-2 and in the 2008 LTAP portfolio analysis, the key characteristics of Site C include:

- Site C would deliver firm, reliable energy and capacity that would be highly flexible to adjust to changes in resources or loads.
- Energy would be available during both daily and annual peak periods.
- As the third project on one river system, Site C would optimize upstream storage and regulation by taking advantage of water already stored in the Williston Reservoir.

- Site C would have low greenhouse gas (GHG) emissions, per gigawatt hour, compared to other electricity supply options.
- Electricity generated at Site C would be unaffected by fluctuations in natural gas costs and carbon pricing that could affect other forms of energy supply.

The characteristics of each resource type are an important consideration in BC Hydro’s evaluation and selection of the resources to economically meet a range of demand and thermal generation cost scenarios. The evaluation and selection was done as part of the portfolio analysis in the 2008 LTAP.

⁸ The 2007 BC Energy Plan mandated that 90 per cent of total electricity continues to be clean or renewable, which means no more than 10 per cent may be generated through options such as coal or natural gas.

⁹ Distributed Generation includes net metering for wind and solar (residential and commercial) from the 2005 Resource Options Report.

2.4.4 PORTFOLIO ANALYSIS RESULTS

The need for and costs of future resources are continually changing; the 2008 LTAP attempts to incorporate these uncertainties in its portfolio analysis to identify actions to preserve and implement resource options. This analysis helps to inform how much to conserve, how much to buy and how much to build.

The 2008 LTAP portfolio analysis compares the characteristics and constraints of each resource type in economically meeting the peak and electricity demands on the system. For Site C, its unique characteristics of high energy capability, high capacity and excellent flexibility make it very valuable in meeting these requirements.

BC Hydro evaluated multiple demand and thermal generation cost scenarios to determine whether the addition of Site C to the BC Hydro system continued to be a low-cost resource option. By examining these scenarios, with and without Site C, it was clear that Site C is an attractive resource option that could help meet the future demand for electricity in B.C. Based on the portfolio analysis, Site C was selected in over 95 per cent of the scenarios with a medium or high demand.

The 2008 LTAP indicates that Site C would provide a low-cost, reliable source of electricity resulting in economic benefits to customers, compared to other resource alternatives.

BC Hydro will continually update and re-evaluate both the forecasted demand and planned supply to make sure that its resource plans will provide adequate supply for its customers, while at the same time ensuring the plans remain cost-effective and responsive to government policy.

ADDITIONAL INFORMATION

More information on BC Hydro's 2008 Long-Term Acquisition Plan (LTAP) is available at www.bchydro.com.



3.0 PUBLIC AND STAKEHOLDER CONSULTATION

CHAPTER HIGHLIGHTS

- Public and stakeholder consultation activities in Stage 2 were multi-phased and offered many opportunities for public involvement.
- Between December 2007 and December 2008, BC Hydro conducted three rounds of public and stakeholder consultation. Many hundreds of people participated in 121 meetings over the three rounds of consultation, including 103 stakeholder meetings and 18 open houses.
- During consultation, participants expressed a strong interest in avoiding or mitigating local impacts from the potential Site C project, particularly possible socio-economic effects associated with an influx of construction workers. Environmental concerns were also raised, including potential effects to air quality, water and agricultural land.
- Overall, 57 per cent of consultation participants “strongly” or “somewhat” agreed with pursuing Site C if conservation, upgrading existing equipment, and investing in new sources were insufficient to meet the electricity needs of B.C. More than two-thirds (69 per cent) of provincial consultation participants agreed with this statement, while consultation participants from the Peace region were evenly split (47 per cent agreed and 47 per cent disagreed).

This chapter provides an overview of the comprehensive public and stakeholder consultation process that occurred during Stage 2.

3.1 BACKGROUND

BC Hydro first seriously considered Site C in the 1970s. Public meetings specific to a Site C regulatory application started in 1977, a Site C information centre was opened in Fort St. John in 1980, and additional public meetings and open houses were held prior to the filing of an application for an Energy Project Certification (EPC) process with the British Columbia Utilities Commission (BCUC) in 1981. The resulting year-long application review process included hearings and input from First Nations communities, local residents and regulatory agencies. The BCUC ultimately denied the project, saying that more work was required around the future demand for electricity and alternatives to the project.

BC Hydro undertook no further public consultation on Site C until 1989. Between 1989 and 1991, consultation included a regional public consultation committee, focus groups, open houses and newsletters. In 1991, a decision was made to put the project on hold. Most recently, through the BC Hydro Integrated Electricity Plan (IEP) process

in 2006, Site C was again raised in the context of available future supply options. The 2006 IEP process included regional and provincial consultation regarding a number of potential resource options, including discussion of Site C. Then in 2007, the provincial government's *BC Energy Plan* directed BC Hydro to "enter into initial discussions with First Nations, the Province of Alberta, and communities to discuss Site C to ensure that communications regarding the potential project and the processes being followed are well known."

Consultation at this early stage in project planning and development is in addition to the consultation that would occur as part of an environmental and regulatory review, should the project advance to Stage 3. Formal consultation processes are required under federal and provincial environmental assessment processes and through the BCUC.



The community consultation office in Fort St. John opened on January 7, 2008.

3.2 PURPOSE

The public and stakeholder consultation program for Stage 2 of the Site C project was designed to meet or exceed best practices. Consultation activities were designed to be multi-phased and offer many opportunities for public input, consistent with BC Hydro's commitment to consultation.

BC Hydro involved the public and stakeholders in designing the consultation process consistent with best practices for accountability, inclusiveness, transparency, commitment and responsiveness.¹⁰ In all consultation materials and in public meetings, consultation participants were advised that the provincial government was the decision maker regarding whether Site C would proceed to the next stage of project planning. Participants were further advised that their input would be considered, along with technical and financial information, in developing and making a recommendation to the provincial government.

The purpose of Stage 2 activities related to consultation was to:

- Consult with the public and stakeholders on potential impacts, benefits and features of the Site C project.
- Consider public input, along with technical, environmental and economic information.
- Keep communities, stakeholders and the public informed about the potential project and the many opportunities for public participation.

PUBLIC NOTICE

**OF PROJECT DEFINITION CONSULTATION, ROUND 2
FOR THE POTENTIAL
PEACE RIVER SITE C HYDRO PROJECT
OCTOBER 1 – NOVEMBER 30, 2008**

BC Hydro is inviting communities, stakeholders and the public to participate in the upcoming Project Definition Consultation. **Round 2** for the potential Peace River Site C Hydro Project, Site C is one of several options being considered to help meet B.C.'s future electricity needs.


The Consultation took place December 2007 – February 2008. Project Definition Consultation is being undertaken in two rounds: **Round 1** took place from May – June 2008. **Round 2** consultation is taking place October 1 – November 30, 2008.

Feedback will be used along with technical and financial input to refine elements of the potential project's design and to assist in defining the scope and nature of ongoing environmental and other studies.

Multi-Stage Evaluation and Consultation Program
BC Hydro is undertaking a stage-by-stage approach for evaluating Site C as a potential option to meet B.C.'s future electricity needs. At the end of each stage of the process, BC Hydro will make a recommendation to government for a decision on whether to proceed to the next stage of project planning and development.

We Want to Hear From You
Consultation materials will be available online beginning October 1, 2008. You can provide feedback and learn more by:

- Attending **multi-stakeholder meetings** (email sitec@bchydro.com to sign up)
- Attending **open houses** (visit www.bchydro.com/sitec to view schedule)
- **Online feedback form:** www.bchydro.com/sitec
- **Postcard mailer**
- **Written submissions:** sitec@bchydro.com or PO Box 2218, Vancouver, B.C. V6B 3W2
- Visiting the **Community Consultation Office:** 9968 107 Ave, Fort St. John
- **Toll-free phone:** 1 877 217-0777
- **Fax:** 604 623-4332 or 250 785-3570

BC Hydro 
FOR GENERATIONS
www.bchydro.com/sitec

¹⁰ For an overview of best practices that guided BC Hydro's consultation, see the International Association of Public Participation (IAP2) core values (www.iap2.org) and the report, *Public Participation: Principles and Best Practices for British Columbia*, Office of the Auditor General of British Columbia, November 2008.

3.3 SCOPE

BC Hydro conducted three rounds of public and stakeholder consultation regarding the Site C project between December 2007 and December 2008. The consultation included Pre-Consultation, which asked local, regional and provincial stakeholders how they wanted to be consulted and about what topics, followed by two rounds of Project Definition Consultation, on key impacts, benefits and features of the potential Site C project.

Consistent with best practices in public consultation, stakeholder feedback from Pre-Consultation directly informed the consultation methods, as well as the topics of consultation during the two subsequent rounds of Project Definition Consultation.

There were many ways to participate in Stage 2 public consultation, including:

- Attending stakeholder meetings and open houses (held in the Peace region, northern B.C., the Lower Mainland and on Vancouver Island).
- Completing feedback forms (online or in person).
- Mailing, faxing or emailing written submissions.
- Calling the Site C toll-free information line.
- Visiting the Fort St. John or Hudson's Hope community consultation offices.

Public notice of consultation opportunities included 105 advertisements in 16 newspapers, radio advertisements on 11 stations in northern B.C., and thousands of notification emails to stakeholders. In addition, 21,000 mailers were sent to households in the Peace River region, prior to the first and second rounds of consultation. Public notice also included a bill insert to 1.3 million BC Hydro residential customers prior to the second round of project definition consultation in October 2008.

Many hundreds of people participated in 121 meetings over the three rounds of consultation, including 103 stakeholder meetings and 18 open houses. Table 3-1 provides an overview of participation in the three rounds of public and stakeholder consultations.

The following sections provide a breakdown of results from each phase of consultation.

TABLE 3-1: PARTICIPATION IN PUBLIC AND STAKEHOLDER CONSULTATIONS

PRE-CONSULTATION (December 4, 2007 – February 15, 2008)	ROUND 1 CONSULTATION (May 1 – June 30, 2008)	ROUND 2 CONSULTATION (October 1 – December 3, 2008)
<ul style="list-style-type: none"> • 687 total participants¹¹ 	<ul style="list-style-type: none"> • 936 total participants 	<ul style="list-style-type: none"> • 909 total participants
<ul style="list-style-type: none"> • 400 participants attended 48 stakeholder meetings 	<ul style="list-style-type: none"> • 284 participants attended 29 stakeholder meetings 	<ul style="list-style-type: none"> • 358 participants attended 26 stakeholder meetings
<ul style="list-style-type: none"> • 56 people attended a public meeting and open house in Hudson’s Hope 	<ul style="list-style-type: none"> • 380 people attended 10 open houses 	<ul style="list-style-type: none"> • 326 people attended 7 open houses
<ul style="list-style-type: none"> • 305 feedback forms returned (67 online, 238 hardcopy) 	<ul style="list-style-type: none"> • 224 feedback forms returned (76 online, 148 hardcopy) 	<ul style="list-style-type: none"> • 345 feedback forms returned (177 online, 168 hardcopy)
<ul style="list-style-type: none"> • 31 submissions (fax, email, phone and mail) 	<ul style="list-style-type: none"> • 22 submissions (fax, email, phone and mail) 	<ul style="list-style-type: none"> • 72 submissions (fax, email, phone and mail)
<ul style="list-style-type: none"> • 200 visits to Fort St. John Community Consultation Office 	<ul style="list-style-type: none"> • 250 visits to Fort St. John Community Consultation Office 	<ul style="list-style-type: none"> • 153 visits to Fort St. John and Hudson’s Hope community consultation offices

Some participants attended meetings in each of the three rounds of consultation.

A consultation summary report for each round of consultation was independently written and posted on the BC Hydro website, along with notes taken at the consultation meetings by independent note takers.



Pre-Consultation Discussion Guide 2007.



Project Definition Consultation, Round 1 Discussion Guide 2008.



Project Definition Consultation, Round 2 Discussion Guide 2008.

¹¹ Total participants include all categories except feedback forms, as most who submitted feedback forms participated in stakeholder meetings or open houses or visited a community consultation office.

3.4 KEY FINDINGS

3.4.1 PRE-CONSULTATION

In Pre-Consultation, BC Hydro asked participants how they wanted to be consulted and about the topics they wished to discuss.

Pre-Consultation was held from December 4, 2007 through February 15, 2008, and provided the following opportunities for participation:

- Pre-Consultation Discussion Guide and Feedback Form
- 48 stakeholder meetings
- 1 public meeting and open house
- Website and online feedback form
- Submissions (fax, email and mail)
- Toll-free Site C information line
- Fort St. John Community Consultation Office

3.4.1.1 PRE-CONSULTATION NOTIFICATION

In Pre-Consultation, approximately 75 local, regional and provincial stakeholder groups were contacted by letter, email and phone to participate in stakeholder meetings. In addition, BC Hydro issued an information bulletin to media advising of the consultation process and the availability of consultation materials on the project website.

- 10 advertisements were placed in 10 newspapers in northern B.C. informing the public about the opening of the Fort St. John Community Consultation Office and reminding people of opportunities to participate in Pre-Consultation.

3.4.1.2 KEY FINDINGS – WHAT WE HEARD¹²

Participants expressed the following key themes in Pre-Consultation:

- Questions and concerns regarding local impacts.
- An interest in how and when Site C would be compared to energy alternatives.
- An interest in the consultation process and in participating in the subsequent Project Definition Consultation.

Public input during Pre-Consultation also informed specific consultation methods undertaken during Project Definition Consultation. For example, Peace region participants expressed a higher degree of interest in open houses than provincial participants (82 per cent versus 38 per cent). As a result of this feedback, a number of open houses were held in the Peace region, as well as a number of stakeholder meetings.

BC Hydro subsequently opened a community consultation office in Hudson's Hope based on feedback received from the community.

Pre-Consultation also informed BC Hydro that mail was rated highly by Peace region participants as a public notification method. As a result, prior to both rounds of Project Definition Consultation, BC Hydro sent 21,000 mailers to Peace region households to advise them about consultation opportunities.

In addition, public input during Pre-Consultation informed the topics of consultation during both rounds of Project Definition Consultation. Some of the topics raised most often during Pre-Consultation included elements of project design, recreation, infrastructure, local impacts, land uses, and community benefits. As a result, BC Hydro included as many of these topics as possible in the subsequent rounds of consultation.

A Consideration Memo documenting how Pre-Consultation informed the methods and topics of Project Definition Consultation was completed during Stage 2 and posted at www.bchydro.com/sitec.

3.4.2 PROJECT DEFINITION CONSULTATION, ROUND 1

Project Definition Consultation, Round 1 was held from May 1 to June 30, 2008 and provided the following opportunities for participants to provide their input:

- Project Definition Consultation, Round 1 Discussion Guide and Feedback Form
- 29 stakeholder meetings
- 10 open houses
- Website and online feedback form
- Submissions (fax, email and mail)
- Toll-free Site C information line
- Fort St. John Community Consultation Office

¹² The views represented in Stage 2 consultations reflect the priorities and concerns of consultation participants only. Consultation results may or may not be representative of the views of British Columbians and other stakeholders because participants self-selected into the three rounds of consultation. Although results are presented in the form of percentages, there are no margins of error for this data because there is no probability sample. The sample in question is based on self-selection, for which a sampling error cannot be measured.

3.4.2.1 PROJECT DEFINITION CONSULTATION, ROUND 1 PUBLIC NOTIFICATION

There was extensive public notification for Project Definition Consultation, Round 1, including:

- Approximately 1,000 local, regional and provincial stakeholders were notified of stakeholder meetings by letter, email, fax and telephone.
- 50 advertisements were placed in 11 newspapers in northern B.C., and in the *Vancouver Sun* and *Victoria Times Colonist*, advising the public about opportunities to participate in both stakeholder meetings and open houses.
- 15- and 30-second radio advertisements ran for several weeks on six stations in northern B.C., advising residents of the open houses.
- Approximately 21,000 copies of a mailer were sent to households in the Peace region.

3.4.2.2 PROJECT DEFINITION CONSULTATION, ROUND 1 CONSULTATION TOPICS

The following topics were discussed in Round 1, and were selected due to their importance to communities and stakeholders as indicated during Pre-Consultation.

- Site C as an energy option
- Community and provincial benefits
- Project design elements
 - Reservoir impact lines
 - Water management
- Recreation
 - River-based opportunities
 - Reservoir-based opportunities
- Infrastructure
 - Relocation of segments of Highway 29
 - Worker housing
- Environment
 - Potential increase of fog
 - Impacts on fish
- Land use
 - Heritage resources, such as effects on archaeological sites

3.4.2.3 KEY FINDINGS — WHAT WE HEARD

Results from Project Definition Consultation, Round 1 — including feedback forms, stakeholder meetings and open houses — showed that participants had a strong interest in socio-economic and environmental issues associated with the potential Site C project. In addition, participants commented on the process being used by BC Hydro to evaluate the project. Some specific findings are outlined below.

- Participants expressed a strong interest in avoiding or mitigating local effects, particularly potential socio-economic effects associated with an influx of construction workers.
- When asked to rate the importance of community and provincial benefits, participants gave the highest importance to low-emission energy, dependable energy and potential local community benefits associated with the Site C project, particularly upgrades to infrastructure such as roads, bridges, parks and health facilities.
- Environmental concerns such as effects on air quality, water and land were raised, and were generally deemed more important than factors such as dependable and low-cost electricity.
- Participants were interested in the multi-staged evaluation and consultation process, and the BC Hydro and government decision-making processes and timelines.

3.4.3 PROJECT DEFINITION CONSULTATION, ROUND 2

Project Definition Consultation, Round 2 was held from October 1 to December 3, 2008 and provided the following opportunities for participants to provide their input:

- Project Definition Consultation, Round 2 Discussion Guide and Feedback Form
- 26 stakeholder meetings
- 7 open houses
- Website and online feedback form
- Submissions (fax, email and mail)
- Toll-free Site C information line
- Fort St. John and Hudson's Hope community consultation offices

3.4.3.1 PROJECT DEFINITION CONSULTATION, ROUND 2 PUBLIC NOTIFICATION

There was extensive public notification for Project Definition Consultation, Round 2, including:

- Invitation and reminder emails were sent to stakeholders, inviting and reminding them of opportunities to participate in stakeholder meetings and public open houses, followed by more than 2,000 invitation and reminder phone calls.
- 45 stakeholder and open house print advertisements were placed in 11 newspapers in northern B.C., and in the *Vancouver Sun* and *Business in Vancouver*.
- 15- and 30-second radio advertisements ran on 11 stations in northern B.C. between September 22 and November 23, 2008, advising residents of the open house schedule available on the project website.
- Approximately 21,000 copies of a mailer were sent to households in the Peace region.
- Approximately 1.3 million residential customers received a bill insert regarding the Site C project with their monthly statement between July and September 2008.

3.4.3.2 PROJECT DEFINITION CONSULTATION, ROUND 2 CONSULTATION TOPICS

The following consultation topics were discussed in Project Definition Consultation, Round 2, and were selected due to their importance to communities and stakeholders as indicated during Pre-Consultation and Project Definition Consultation, Round 1:

- Site C as an energy option
- Powerhouse access bridge and associated access roads
- Provincial and community benefits — other potential infrastructure improvements
- Reservoir preparation considerations
- Sourcing dam construction materials and the relocation of excavated soil and rock
- Environment – land use, agriculture, forestry and mining

3.4.3.3 KEY FINDINGS — WHAT WE HEARD

- Overall, 57 per cent of consultation participants “strongly” or “somewhat” agreed with pursuing Site C if conservation, upgrading existing equipment, and investing in new sources were insufficient to meet the electricity needs of B.C.
 - 69 per cent of provincial consultation participants agreed with this, while in the Peace region, consultation participants were evenly split on their level of agreement (47 per cent agreed and 47 per cent disagreed).
- Consistent with input from Pre-Consultation and Project Definition Consultation, Round 1, participants had a strong interest in avoiding or mitigating local impacts, particularly environmental impacts to water, air and land. Mitigating impacts to fish and aquatic habitats and wildlife and terrestrial habitats were also consistently important to participants.
- Participants in Project Definition Consultation, Round 2, were also interested in and supported potential local and provincial benefits, including business contracting and training opportunities for local workers, public use of the powerhouse access bridge and other road improvements, additional city infrastructure such as water and sewer, and recreation opportunities such as campgrounds, RV parks, boat launches and marinas.
- As with the previous rounds of consultation, participants showed a desire for BC Hydro to continue reviewing alternatives to Site C, most notably the further promotion of conservation, as well as other electricity generation options.

As noted in the consultation summary report and meeting notes for the open houses and stakeholder meetings, there were some protests during Project Definition Consultation, Round 2. Between 7 and 15 people attended stakeholder meetings in Hudson’s Hope, Dawson Creek and Fort St. John to protest. In addition, between 10 and 25 people attended open houses in Dawson Creek/Pouce Coupe and Fort St. John to protest.

3.4.4 CONSIDERATION OF PUBLIC FEEDBACK FROM PROJECT DEFINITION CONSULTATION

In Stage 2, BC Hydro considered input received from the public and stakeholders — along with technical and financial input — to refine features of the project and the scope and nature of environmental and other studies. Table 3-2 provides a few examples of how BC Hydro considered public input.

TABLE 3-2: EXCERPT FROM BC HYDRO'S CONSIDERATION OF PUBLIC FEEDBACK

The following table includes a selected sample of public feedback and BC Hydro actions. It does not represent a complete sample. To review the complete consideration memo, please visit www.bchydro.com/sitec.

PUBLIC FEEDBACK	BC HYDRO ACTION
Project Definition Consultation, Round 1	
Environmental and Engineering Studies – participants were interested in more information regarding environmental and engineering studies that were underway.	As a result of this interest, BC Hydro released a list of studies that would be undertaken during Stage 2 or future stages, and produced study outlines on environment studies initiated in Stage 2. The list of Stage 2 studies was also posted on the BC Hydro website.
Recreational Opportunities – participants wanted assurances that recreational opportunities would be created or maintained if the project proceeds.	BC Hydro committed that its reservoir preparation plan would examine recreational opportunities, flagging high-risk areas, and would ensure that appropriate recreational access sites were found.
Impact Lines – participants were generally in agreement with the impact lines approach, but expressed concerns about the instability of the banks.	In its consideration, BC Hydro acknowledges that the impact line approach is currently draft and will require further study. Going forward, BC Hydro will develop monitoring plans for slope stability concerns. If the project were to proceed, monitoring would also be planned for construction and maintenance. In addition, erosion studies are being completed by a third-party expert and will be peer-reviewed. BC Hydro is also installing temporary monitoring wind stations to collect wind data to inform understanding of potential erosion. (see Chapter 6 for more information on impact lines).
Community Benefits – participants were interested in local community benefits, particularly upgrades to infrastructure such as roads, bridges, parks and health facilities.	Based on early public feedback, BC Hydro sought public and stakeholder input regarding possible public use of the powerhouse access bridge and associated access roads as well as for ideas concerning potential improvements to other community infrastructure, such as regional parks, housing and other amenities. Local parks may be located along the potential reservoir or closer to towns and other residential areas. Other amenities could include additional city infrastructure such as water and sewer services.
Project Definition Consultation, Round 2	
Reservoir Clearing – participants wanted assurances that BC Hydro would properly clear the reservoir to minimize effects on recreation areas and greenhouse gas emissions.	As a result of this feedback, BC Hydro asked participants for comments on reservoir preparation considerations in Project Definition Consultation, Round 2 and began work on a preliminary reservoir clearing plan.

3.4.5 OTHER COMMUNICATIONS AND COMMUNITY RELATIONS ACTIVITIES

In addition to three rounds of public consultation during Stage 2, BC Hydro also implemented several other communications and community relations initiatives, as described below.

Fort St. John and Hudson's Hope Community Consultation Offices

BC Hydro opened a community consultation office in Fort St. John on January 7, 2008. Subsequently, in response to stakeholder requests, a community consultation office was opened in Hudson's Hope on October 7, 2008.

The community consultation offices provide a place where people can get information about the Site C project, ask questions and submit feedback forms. During the three rounds of consultation, there were more than 600 visits to the community consultation offices.

Field Studies Communications Program

As part of Stage 2, BC Hydro conducted environmental, socio-economic and engineering field studies on and around the Peace River, between the Williston Reservoir and the B.C. - Alberta border. Several field studies originally contemplated for later dates were prioritized to Stage 2 in response to feedback received from stakeholders in early rounds of consultation. BC Hydro produced a series of information sheets to notify residents of the timing of field studies in the area and to provide information about the scope and nature of the studies. All field studies information sheets were made available at www.bchydro.com/sitec.

Public Inquiry Program

BC Hydro established a public inquiry-response program to provide timely, accurate information in response to requests for information regarding the potential Site C project. Inquiries could be made through a toll-free information line, by email, and in person at the community consultation offices.

Property Owner Consultation

Since December 2007, as part of the Stage 2 consultation and technical review program, BC Hydro has been meeting with owners whose properties could be impacted by the potential Site C project. In fall 2008 and winter 2009, BC Hydro met individually with potentially impacted property owners to discuss the realignment options for sections of Highway 29 that would be needed if the project proceeds. The purpose of this consultation was to provide information, gather further input from property owners, determine owner preferences in terms of possible highway realignment options and hear property owner concerns. This property owner consultation is discussed further in Chapter 5.

3.4.6 CONSULTATION WITH THE PROVINCE OF ALBERTA AND THE NORTHWEST TERRITORIES

In addition to consulting with communities and Aboriginal groups, the *BC Energy Plan* also specified that the Province and BC Hydro consult with the Province of Alberta. Subsequently, the provincial government provided direction to include the Northwest Territories in interprovincial consultation.

BC Hydro has played a supporting role to this initial consultation, as it is the provincial government that takes the lead on any interprovincial consultation involving other governments and agencies.

BC Hydro is, however, directly consulting and engaging with Aboriginal groups in Alberta and the Northwest Territories. Aboriginal consultation and engagement is discussed further in Chapter 4.

3.5 NEXT STEPS

Consultation would occur in each stage of the Site C project.

If the project advances to an environmental and regulatory review, there will be additional consultation opportunities for the public, Aboriginal groups, stakeholders and communities. In addition, if the project proceeds, BC Hydro would continue to consider input from the public and stakeholders in the next phase of project planning and development.



Inside the community consultation office in Fort St. John.

ADDITIONAL INFORMATION

Consultation summary reports and materials were completed for all three rounds of consultation during Stage 2. The following reports and materials are available at www.bchydro.com/sitec.

Pre-Consultation

Peace River Site C Hydro Project: Pre-Consultation Discussion Guide and Feedback Form, December 2007. BC Hydro. 2007.

Public Notification Materials, Pre-Consultation.

BC Hydro Peace River Site C Hydro Project: Pre-Consultation Summary Report, March 15, 2008.

Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.

Peace River Site C Hydro Project: Consideration of Input from Pre-Consultation, December 4, 2007 to February 15, 2008. BC Hydro. 2008.

Project Definition Consultation, Round 1

Peace River Site C Hydro Project: Project Definition Consultation Discussion Guide and Feedback Form, Round 1: May/June 2008. BC Hydro. 2008.

Public Notification Materials, Round 1 Consultation.

BC Hydro Peace River Site C Hydro Project: Project Definition Consultation, Round 1 Summary Report, September 26, 2008. Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.

Project Definition Consultation, Round 2

Peace River Site C Hydro Project: Project Definition Consultation Discussion Guide and Feedback Form, Round 2: October/November 2008. BC Hydro. 2008.

Public Notification Materials, Round 2 Consultation.

BC Hydro Site C Hydro Project: Project Definition Consultation, Round 2 Summary Report, February 9, 2009. Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.

Peace River Site C Hydro Project: Stage 2 Consideration of Public Consultation Input. BC Hydro. 2009.

4.0 ABORIGINAL CONSULTATION AND ENGAGEMENT

CHAPTER HIGHLIGHTS

- During Stage 2, BC Hydro initiated consultation and engagement with 41 Aboriginal groups consisting primarily of Treaty 8 First Nations in B.C., as well as Aboriginal groups in Alberta and the Northwest Territories (NWT).
- The primary purpose of this early consultation is to provide information to Aboriginal groups about the Site C project, identify their interests and concerns, and increase knowledge and understanding about the potential effects and impacts of the Site C project.
- Consultation agreements were negotiated where BC Hydro determined that more in-depth engagement was required. Eight consultation agreements representing 13 Aboriginal groups were negotiated during Stage 2.
- Aboriginal consultation for the Site C project is ongoing. BC Hydro and Aboriginal groups are engaged in a thorough consultation and engagement process that would continue through all stages of the project, should it proceed.

This chapter on Aboriginal consultation and engagement is primarily intended as a process update. It includes an update on the activities that are taking place, and lists some of the substantive issues identified by Aboriginal groups to date.

4.1 BACKGROUND

During Stage 1, BC Hydro reported that dialogue with Aboriginal groups was needed to fully understand the issues, concerns and potential impacts of the Site C project on Aboriginal groups and provide input into which studies to undertake.

The Supreme Court of Canada has also established the need for consultation and, where appropriate, accommodation to take place with Aboriginal groups in decisions that may affect their Aboriginal or treaty rights.

BC Hydro is committed to consulting and, where appropriate, accommodating Aboriginal groups in respect of projects such as Site C. BC Hydro actively seeks out opportunities to engage Aboriginal people in its business operations and to build understanding of Aboriginal issues and interests among its staff. Best practices are employed by consulting with Aboriginal communities in the early stages of projects, policy and program development, thereby enhancing opportunities to find mutually beneficial arrangements and outcomes. This approach is being applied to the potential Site C project.

4.2 PURPOSE

The primary objectives of consultation and engagement with Aboriginal groups in Stage 2 are to:

- Consult with Aboriginal groups to share information about the potential Site C project, identify their interests and concerns, obtain their feedback, and increase knowledge and understanding about potential project effects and impacts.
- Where possible, recognizing that the project is in the early planning stages, attempt to identify potential mitigation measures and options for accommodation.

4.3 SCOPE

In Stage 2, BC Hydro initiated consultation and engagement with 41 Aboriginal groups consisting primarily of Treaty 8 First Nations in B.C., as well as Aboriginal groups in Alberta and the Northwest Territories (NWT).

Prior to any substantive consultation or engagement taking place, preparatory work was undertaken to identify the Aboriginal groups

who may have an interest in the Site C project. BC Hydro reviewed publicly available information and drew upon the internal resources of BC Hydro Aboriginal Relations and Negotiations (ARN) to determine the Aboriginal groups who may exercise traditional practices or interests in the Peace River watershed. This work recognized the extensive reach of the Peace River, its numerous tributaries and, in contemplating this issue, BC Hydro elected to be more, rather than less, inclusive in its approach to consultation.

The scope of consultation and engagement varied from notification of the potential project for those Aboriginal groups with little or no anticipated impact, to consultation aimed at indentifying potential effects on those group who may experience direct impacts and, thus, laying the groundwork to finding future satisfactory solutions and accommodations with those Aboriginal groups.

Once the relevant Aboriginal groups to be consulted were identified, introductory letters were sent, along with copies of the report, *Summary: Stage 1 Review of Project Feasibility*. Introductory and follow-up meetings were then completed with a number of Aboriginal groups. Based on these initial meetings, consultation agreements were negotiated with groups where BC Hydro determined that more in-depth consultation was required. During Stage 2, eight consultation agreements representing 13 Aboriginal groups were negotiated. BC Hydro anticipates additional consultation agreements with other Aboriginal groups, should the project proceed to Stage 3.

As well, BC Hydro will continue to be available for future engagements at the request of any Aboriginal group.

In Stage 2, BC Hydro also sought input from those Treaty 8 First Nations with the strongest interests in the Site C project on a wide range of studies related to the environment, archaeology, socio-economic conditions and land use. Members from some First Nations also participated in Stage 2 field studies as monitors where they assisted in selected projects related to fish and wildlife, weed mapping and knapweed control. As such, they were able to observe field studies first-hand, while benefiting directly from employment, training and capacity-building opportunities. In many instances, First Nations shared traditional use and ecological knowledge as advisors or monitors in the field for the geotechnical investigations.

TABLE 4-1: FIRST NATIONS AND MÉTIS COMMUNITIES WHO HAVE BEEN CONTACTED/ENGAGED REGARDING THE POTENTIAL SITE C PROJECT IN B.C., ALBERTA AND THE NORTHWEST TERRITORIES

	BRITISH COLUMBIA	ALBERTA	NORTHWEST TERRITORIES
TREATY 8	Council of Western Treaty 8 Chiefs <ul style="list-style-type: none"> • Doig River • Fort Nelson • Halfway River • Prophet River • Saulteau • West Moberly Blueberry River McLeod Lake	Athabasca Chipewyan Beaver Bigstone Cree Nation Chipewyan Prairie Dene Tha' Driftpile Duncan's Fort McKay Fort McMurray #468 Horse Lake Kapawe'no Little Red River Cree Loon River Cree Lubicon Lake Mikisew Cree Sawridge Sturgeon Lake Cree Sucker Creek Swan River Tallcree Whitefish Lake Woodland Cree	Deninu K'ue Lutsel K'e Dene Salt River Smith's Landing Yellowknives Dene First Nation
B.C. NON-TREATY	Kwadacha Tsay Keh Dene		
MÉTIS	Kelly Lake	Paddle Prairie Fort Chipewyan Métis Association	Northwest Territory Métis Nation

4.4 KEY FINDINGS

In general, grievances related to past BC Hydro projects are a concern raised by most of the Aboriginal groups consulted. The potential Site C project is viewed by these groups as exacerbating the unresolved impacts of the W.A.C. Bennett Dam. To address the impediments to dialogue on the proposed project, BC Hydro is committed to hearing, where applicable, the concerns related to past grievances in separate discussions.

Cumulative effects of past and current projects on the region, including those from other industry sectors (e.g., oil and gas, mining), are also a common concern expressed by many

Aboriginal groups. Cumulative effects would be scoped appropriately and examined during an environmental and regulatory review process, should the project advance.

Short- and long-term employment and economic opportunities related to the potential Site C project are of interest to all the Aboriginal groups consulted. BC Hydro is working with Aboriginal groups to identify opportunities for Aboriginal participation in the potential project.

4.4.1 BRITISH COLUMBIA

In B.C., Aboriginal groups consulted during Stage 2 expressed concern about the potential project's direct effects on land and water where treaty rights to hunt, fish and trap may be exercised, as well as the possible impacts to their cultural and heritage resources. The following section summarizes the issues raised.

4.4.1.1 WILDLIFE

In the area of wildlife, Treaty 8 First Nations raised questions about the winter feeding, migration patterns and calving grounds of ungulates in the flooded areas. As well, there is concern that the project may increase recreational access to hunting areas. All Aboriginal groups consulted in B.C. emphasized the importance of incorporating traditional knowledge into any study undertaken by BC Hydro on wildlife and fish.

4.4.1.2 FISH AND WATER

To date, questions related to fish have focused on the distribution, abundance, habitat and spawning migration for species in the Peace River and its tributaries. First Nations expressed concern about potential issues related to fish and other aquatic life, including changes to the water through the creation of the reservoir (habitat loss, fluctuation levels, methyl mercury — see section 7.4.1.3 on page 84 for more information on methyl mercury), and through potential chemical releases (from construction materials, potential releases of tar from the flooding of sections of Highway 29, and potential discharges from the Fort St. John landfill).

4.4.1.3 CULTURAL HERITAGE

Issues related to culture and heritage are of key importance to Treaty 8 First Nations. The potential inundation of important places where communities meet and practice traditional activities such as hunting and gathering (particularly medicinal plants), and the loss of burial sites and artifacts raise significant concerns for Aboriginal groups.

4.4.1.4 NEXT STEPS – WILDLIFE, FISH AND CULTURAL HERITAGE

Should the project advance to Stage 3, which includes an independent environmental and regulatory review, BC Hydro is committed to ensuring that environmental, social and cultural heritage studies currently underway will be continued and updated as required. Furthermore, if the project advances to the next stage, studies would transition from baseline work to effects assessment studies. The purpose of this work is to further inform BC Hydro and Aboriginal groups of any potential impacts from the Site C project on these resources of particular concern. In addition, this information will be considered to further inform the design of the potential Site C project.

4.4.1.5 BROADER ISSUES

As residents of the Peace region, B.C. Treaty 8 First Nations are also expressing concerns similar to those of the broader community about the potential Site C project. These include conservation strategies, the exploration of alternative energy sources, impacts on existing transportation corridors and patterns (i.e., highway realignment and potential public use of the access bridge) and socio-economic effects from a large workforce in the region during construction.

4.4.1.6 TIMING OF STAGE 2

One specific concern raised by the Council of Western Treaty 8 Chiefs, which represents six B.C. Treaty 8 First Nations (see Table 4-1), is the timing of this Stage 2 report and BC Hydro's recommendation to the provincial government on the Site C project. The concerns are documented in a submission available on the BC Hydro website (www.bchydro.com/sitec), along with BC Hydro's response.

4.4.2 ALBERTA AND THE NORTHWEST TERRITORIES

Issues related to fish and hydrology (water temperature, flows and quality) are of concern to Aboriginal groups downstream in Alberta and the NWT. In communities where people continue to rely daily on the river for transportation routes and food sources, even minor fluctuations in the water regime are of interest.

BC Hydro is committed to ensuring that information relevant to Site C's impacts on the downstream environment will be provided to downstream communities. In addition, Aboriginal groups will be provided with adequate resources to seek expert advice to consider BC Hydro's information and to enable this information to be communicated effectively to community members.

As discussed in the Stage 1 report, Aboriginal groups living around the Peace-Athabasca Delta (PAD) continue to raise historical grievances related to the construction of the W.A.C. Bennett Dam and its perceived effect on the hydrology, wildlife and their traditional way of life. BC Hydro is continuing to work with Aboriginal groups to address this issue.

4.5 NEXT STEPS

Aboriginal consultation for the Site C project is ongoing. BC Hydro and Aboriginal groups are engaged in a thorough consultation process that would continue through all stages of the project, should it proceed.

If the project advances to an environmental and regulatory review, Aboriginal consultation will continue with a focus on impact assessment, mitigation and accommodation.

ADDITIONAL INFORMATION

The following reports regarding Aboriginal consultation and engagement are available at www.bchydro.com/sitec.

Treaty 8 First Nations Report on Stage 2 Consultation. Treaty 8 Tribal Association. 2009.

BC Hydro Response to Treaty 8 Tribal Association's Submission on Stage 2 Consultation. BC Hydro. 2009.



The Peace River, downstream from Bear Flat.

5.0 PROPERTIES AND HIGHWAY 29 CONSULTATION

CHAPTER HIGHLIGHTS

- As part of its Stage 2 work, BC Hydro representatives met with individuals whose property could be directly impacted by the realignment of four sections of Highway 29 and/or flooding. The purpose of this consultation was to keep property owners informed about the potential Site C project and gather feedback.
- During Stage 2, BC Hydro conducted more detailed mapping of the lands that would be affected by the potential reservoir area. There are approximately 5,340 hectares of flooded land in the reservoir area, of which 81 per cent is Crown land, 12 per cent is owned by BC Hydro and seven per cent is privately owned land.
- If a decision is made to advance the potential Site C project to the next stage, BC Hydro would continue to consult and liaise with affected property owners and leaseholders.

This chapter provides an overview of BC Hydro's Stage 2 work regarding properties and Highway 29 consultations.

Highway 29 crossing the Halfway River at the Peace River.

5.1 BACKGROUND

5.1.1 ABOUT PROPERTY SERVICES

BC Hydro's Property Services function has four key roles in the Site C project. First, it provides dedicated property representatives to consult and inform property owners and leaseholders about the project and answer any specific property-related questions. Second, it supports the Site C project by securing various property tenures and rights that allow for ongoing project work. Third, it manages the Passive Property Acquisition Program. Fourth, it ensures that BC Hydro-owned property is managed in a manner that supports and promotes good stewardship of the lands and contributes to the local economy.

In the *Site C Feasibility Review: Stage 1 Completion Report*, BC Hydro stated, "Wherever possible, farmland and ranchland acquired by BC Hydro is being maintained in productive use, either by leasing it back to the original owner or to another tenant where the original owner did not elect to remain."

Property impacted by the potential Site C project includes provincial Crown land, BC Hydro-owned property, and private property. There is no federal Crown land within the potential project area.

Potential impacts to property as a result of the potential Site C project include:

- Flooding – the area of land that would be flooded by the creation of a reservoir.
- Reservoir impact lines – the specified land area around the reservoir that would see some limits placed on its use to enhance public safety.
- Shoreline protection – areas of the shoreline that are publicly accessed and where protection, such as constructing a berm, would be feasible.
- Highway 29 realignment – four segments of Highway 29 from Fort St. John to Hudson's Hope would need to be relocated due to flooding.
- Dam site – land impacted by the location of the dam site and powerhouse.
- Sourcing construction materials – land that would be impacted by sourcing construction materials for the dam.
- Access roads and powerhouse access bridge – land potentially impacted by the construction of access roads and the powerhouse access bridge downstream of the potential dam site.
- Transmission – transmission requirements from the potential Site C dam to the existing Peace Canyon generating station. This is an existing transmission corridor and no private land would be impacted.



Highway 29 at Farrell Creek.

5.1.2 PASSIVE PROPERTY ACQUISITION PROGRAM

During the 1970s and early 1980s — up until commencement of the British Columbia Utilities Commission (BCUC) hearings of 1981/1982 — BC Hydro was actively purchasing properties that had the potential to be impacted by the Site C project. Most of the privately owned lands potentially impacted by the project were acquired by BC Hydro between 1977 and 1981.

Based on the recommendations of the BCUC in the early 1980s, and in an effort to minimize disruption to the local real estate market, BC Hydro introduced the Passive Property Acquisition Program. Under this program, affected property owners are able to voluntarily sell their property to BC Hydro, should they be interested. The property is purchased by BC Hydro based on an independent appraisal of the property and upon reaching a negotiated agreement. Property owners have the opportunity to lease back the property they have sold to BC Hydro.

As part of this program, all property owners who have sold their property to BC Hydro in relation to the Site C project have the right to repurchase the property, at the original price paid, if the project is abandoned.

BC Hydro has not actively promoted the purchase of the lands in the area for more than two decades. However, BC Hydro responds to requests from property owners who have an interest in selling their property.

The Passive Property Acquisition Program continues to be in effect. During Stage 2, a number of property owners requested details of the Passive Property Acquisition Program, and five residential properties were sold to BC Hydro.

5.2 PURPOSE

The primary objectives of Stage 2 work for Property Services were to:

- Keep property owners and leaseholders informed about the Site C project and how they may be impacted, based on historical engineering information.
- Consult with individual owners whose property could be directly impacted by potential highway realignment options.
- Assist with the mapping of properties that may be directly affected by the Site C project, if it proceeds, with a specific focus on flooding impacts and Highway 29 realignment options.
- Obtain permissions from property owners and leaseholders for BC Hydro to enter private lands to conduct environmental and engineering field studies.
- Manage BC Hydro-owned properties in the project area.

5.3 SCOPE

The scope of BC Hydro's activities on properties during Stage 2 included the following:

- Establish dedicated properties representatives to consult and inform potentially impacted leaseholders and property owners about the project.
- Identify owners and leaseholders, and map the boundaries of Crown land and private properties that may be affected by the potential Site C project, including:
 - Flooding
 - Potential highway realignments
- Secure access to public and private land where necessary for environmental and engineering field studies.
- Meet one-on-one with potentially affected property owners and leaseholders.
- Acquire properties around the potential Site C project area, if approached by property owners, consistent with the Passive Property Acquisition Program.

5.3.1 CONSULTATION WITH PROPERTY OWNERS

BC Hydro has been consulting with property owners since November 2007.

Potentially impacted property owners generally expressed appreciation for being notified directly about impacts to their property, rather than at public meetings. Should the project proceed to the next stage, this method of communication would continue.

The following lists some of the ways property owners have been consulted and kept informed during Stage 2:

November 2007 – January 2008	<ul style="list-style-type: none"> • Mailed and hand-delivered letters to potentially impacted property owners just prior to public notification regarding Pre-Consultation. • Follow-up calls from BC Hydro regarding Pre-Consultation.
January 2008	<ul style="list-style-type: none"> • Established and operated the Site C Community Consultation Office in Fort St. John.
November 2007 – February 2008	<ul style="list-style-type: none"> • BC Hydro visits with property owners before and during Pre-Consultation.
December 4, 2007 – February 15, 2008	<ul style="list-style-type: none"> • Pre-Consultation.
May 1 – June 30, 2008	<ul style="list-style-type: none"> • Project Definition Consultation, Round 1.
October 1 – December 3, 2008	<ul style="list-style-type: none"> • Project Definition Consultation, Round 2.
September 2008	<ul style="list-style-type: none"> • Letter sent to property owners informing them of consultation on Highway 29 realignment.
February 2008 – October 2008	<ul style="list-style-type: none"> • BC Hydro contact with property owners regarding field study property access and permission.
October 2008	<ul style="list-style-type: none"> • Established and operated the Site C Community Consultation Office in Hudson's Hope.
November 2008 – February 2009	<ul style="list-style-type: none"> • Consultation with property owners regarding Highway 29 realignment options.
Ongoing	<ul style="list-style-type: none"> • Meetings and correspondence with property owners.

5.3.2 PROPERTY OWNER CONSULTATION REGARDING HIGHWAY 29 ALIGNMENT OPTIONS

As part of its Stage 2 work, BC Hydro undertook individual consultation with property owners who could be directly impacted by the realignment of four sections of Highway 29 at Bear Flat, Halfway River, Lynx Creek and Farrell Creek and/or by flooding of the Site C reservoir.

The intent of this consultation was to provide further information about potential changes to sections of Highway 29, to gather input specific to individual properties, to determine property owner preferences about the potential alignment options and to document property owner concerns.

Meetings with property owners took place between November 2008 and February 2009. BC Hydro had 29 meetings with the owners of 31 land holdings, accounting for almost three-quarters (74 per cent) of all land holdings potentially impacted by Highway 29 realignment options and/or flooding (Table 5-1). BC Hydro met with 51 individuals in total, as some properties have multiple owners. A number of property owners living outside the Peace region did not respond to mailed materials, and one person declined to meet with BC Hydro.

Most of the meetings took place at property owner homes and included customized material and documented notes.

Should the project proceed to Stage 3, feedback about potential Highway 29 realignment options would be used, along with technical and financial input, to refine elements of the potential project's design and to assist in defining the scope and nature of ongoing environmental, technical and other studies.

TABLE 5-1: PROPERTY OWNER PARTICIPATION – HIGHWAY 29 CONSULTATION

CONSULTATION		Number of Land Holdings	Percentage of Land Holdings
Participated	Meetings between BC Hydro and property owners (November 2008 – February 2009)	31 (51 individuals)	74%
	Owners who returned written comments	2	5%
Did not participate	Owners who live out of the Peace region and did not respond to mailed materials	6	14%
	Owners who have sold property since September 2008	2	5%
	Owners who declined the offer of a meeting	1	2%
TOTAL		42	100%

5.4 KEY FINDINGS

5.4.1 PROPERTIES DIRECTLY IMPACTED BY POTENTIAL RESERVOIR AREA

During Stage 2, BC Hydro conducted more detailed mapping of the lands that would be affected by the potential reservoir area. This mapping provides a preliminary breakdown of the land that would lie within the reservoir area.

There are approximately 9,310 hectares in the potential reservoir surface area, comprising 5,340 hectares of flooded land and 3,970 hectares of current river area.

As shown in Table 5-2, in terms of the flooded land area, 81 per cent is Crown land (4,318 hectares), including unclassified land and road allowances. A further 12 per cent is owned by BC Hydro (662 hectares) and seven per cent is privately owned land (360 hectares comprising 20 land holdings).

Should the project proceed to the next stage, additional work would be required to define the private property impacts, such as sourcing construction materials, reservoir impact lines and Highway 29 realignment.

Prior to construction, should the project advance to this stage, BC Hydro would need to purchase in fee simple the remaining privately owned land in the potential reservoir area.

5.4.2 PROPERTY ACQUISITIONS

Since the 1970s, BC Hydro has acquired 2,337 hectares of privately owned land within the project area,¹³ with more than 90 per cent of these purchases taking place between 1977 and 1981. Of this land, 94 per cent (2,193 hectares) has been leased either to the former property owners or to residents living in the potential project area.

TABLE 5-2: CROWN AND PRIVATE LAND POTENTIALLY IMPACTED BY RESERVOIR SURFACE AREA¹⁴

	Potential Area of Flooding (hectares)	Percentage of Flooded Land Area
Crown land (includes unclassified land and road allowances)	4,318	81%
BC Hydro-owned land	662	12%
Private land ¹⁵	360	7%
TOTAL FLOODED LAND AREA	5,340	100%
Current river area ¹⁶	3,970	
TOTAL RESERVOIR AREA	9,310	

¹³ As of June 30, 2009.

¹⁴ The surface area of the reservoir is based on topography at the elevation of 461.8 metres.

¹⁵ 25.1 hectares of private land is within the existing river channel.

¹⁶ Based on maximum normal operating discharge from Peace Canyon and an estimated average annual flow from the Halfway River.

5.5 NEXT STEPS

If a decision is made to advance the potential Site C project to the next stage, BC Hydro would continue to consult and liaise with affected property owners and leaseholders. Key issues that would require ongoing consultation, as well as further project definition resulting from design and engineering work, include:

- Continued discussion regarding Highway 29 realignment options
- Reservoir impact lines
- Shoreline protection
- Dam site and powerhouse
- Sourcing construction materials
- Access roads and powerhouse access bridge

If a future decision is made to build Site C, additional private land would need to be acquired for the project (e.g., other land required for the reservoir, highway relocation and construction materials). In addition, BC Hydro would need to secure Crown land for the dam site and related infrastructure, as well as lands impacted by reservoir operations and transmission line requirements.

Potential property requirements would be determined if the project proceeds to the environmental and regulatory review stage.

ADDITIONAL INFORMATION

The following report was completed during Stage 2 on properties and Highway 29 consultation. This study is available at www.bchydro.com/sitec.

Peace River Site C Hydro Project - Consultation Summary Report: Property Owner Consultation on Potential Highway 29 Realignment Options, November 2008-March 2009. BC Hydro. 2009.



North bank downstream from potential Site C location.



W.A.C. Bennett Dam and the Williston Reservoir.

6.0 ENGINEERING AND OPERATIONS

CHAPTER HIGHLIGHTS

- During Stage 2, BC Hydro undertook additional work on outstanding technical issues related to the design, construction and operation of the potential Site C project.
- As would be expected, there have been many changes in guidelines and construction practices since the majority of the design work and key design choices were made in the late 1970s and 1980s.
- As a result of Stage 2 engineering work, BC Hydro has concluded that a refined and updated design is required to meet current seismic, safety and environmental guidelines and to incorporate input from consultation.

This chapter provides an overview of BC Hydro's Stage 2 work of the engineering and operational issues of the potential Site C project.

6.1 BACKGROUND

The Peace River system has played a key role in British Columbia's integrated electrical system since the development of the G.M. Shrum and Peace Canyon generating stations.

As discussed in the Stage 1 report, five additional hydroelectric development sites were identified on the Peace River in the late 1950s. Sites A, B, C and D between Peace Canyon and Taylor were identified in 1958, based mainly on topographical considerations. Shortly thereafter, Site E was identified just upstream of the Alberta border.

In the early 1970s, studies focused on dams at Sites C and E to develop the full head between Peace Canyon Dam and the Alberta border.

By 1976, engineering studies concentrated on Site C just downstream of the Moberly River, 7 kilometres southwest of Fort St. John and 62 kilometres upstream from the Alberta border.

Engineering work has been undertaken on the Site C project several times throughout its history, but much of this information is now almost three decades old. Feasibility studies and design work established the 1980s layout of the facilities at Site C. In 1989, additional preparatory engineering commenced, but was suspended in 1991 when the project was put on hold. At that point, a number of design issues remained unresolved regarding the dam, spillway, power intakes and powerhouse.

During Stage 1, BC Hydro provided an assessment of outstanding design issues that could impact the project cost, including changes to design guidelines and design issues that have arisen since the previous engineering work was done.



Construction of the Peace Canyon Dam (1975 – 1980).

6.2 PURPOSE

The primary objectives of Stage 2 engineering were to:

- Review and assess outstanding engineering design issues.
- Support and participate in Stage 2 consultation.

6.3 SCOPE

Stage 2 engineering activities included assessing outstanding design issues that were identified in the Stage 1 feasibility review of the potential Site C project. Key topics included:

DAM, SPILLWAY, POWER INTAKES AND POWERHOUSE

- Dam and concrete structures
- Construction sequence and river diversion
- Maximum Design Earthquake
- Foundation rebound
- Pore pressure response
- Construction material sources and relocation of excess excavated materials
- Probable Maximum Flood
- Housing for workers

RESERVOIR AND OPERATIONS

- Reservoir clearing
- Reservoir shoreline conditions and impact lines
- Reservoir operations
- Downstream water flows, sediment and elevations
- Downstream ice

ROADS AND BRIDGES

- Powerhouse access and Peace River crossing
- Relocation of four segments of Highway 29

TRANSMISSION

- Transmission requirements



Highway 29 crossing the Halfway River.

6.4 KEY FINDINGS

During Stage 2, engineering activities provided BC Hydro with new technical information regarding the design, construction and operation of the potential Site C project. Design solutions were found for outstanding technical issues identified in Stage 1, including the dam, spillway, power intakes and powerhouse, reservoir and operations, roads and bridges, and transmission requirements.

6.4.1 DAM, SPILLWAY, POWER INTAKES AND POWERHOUSE

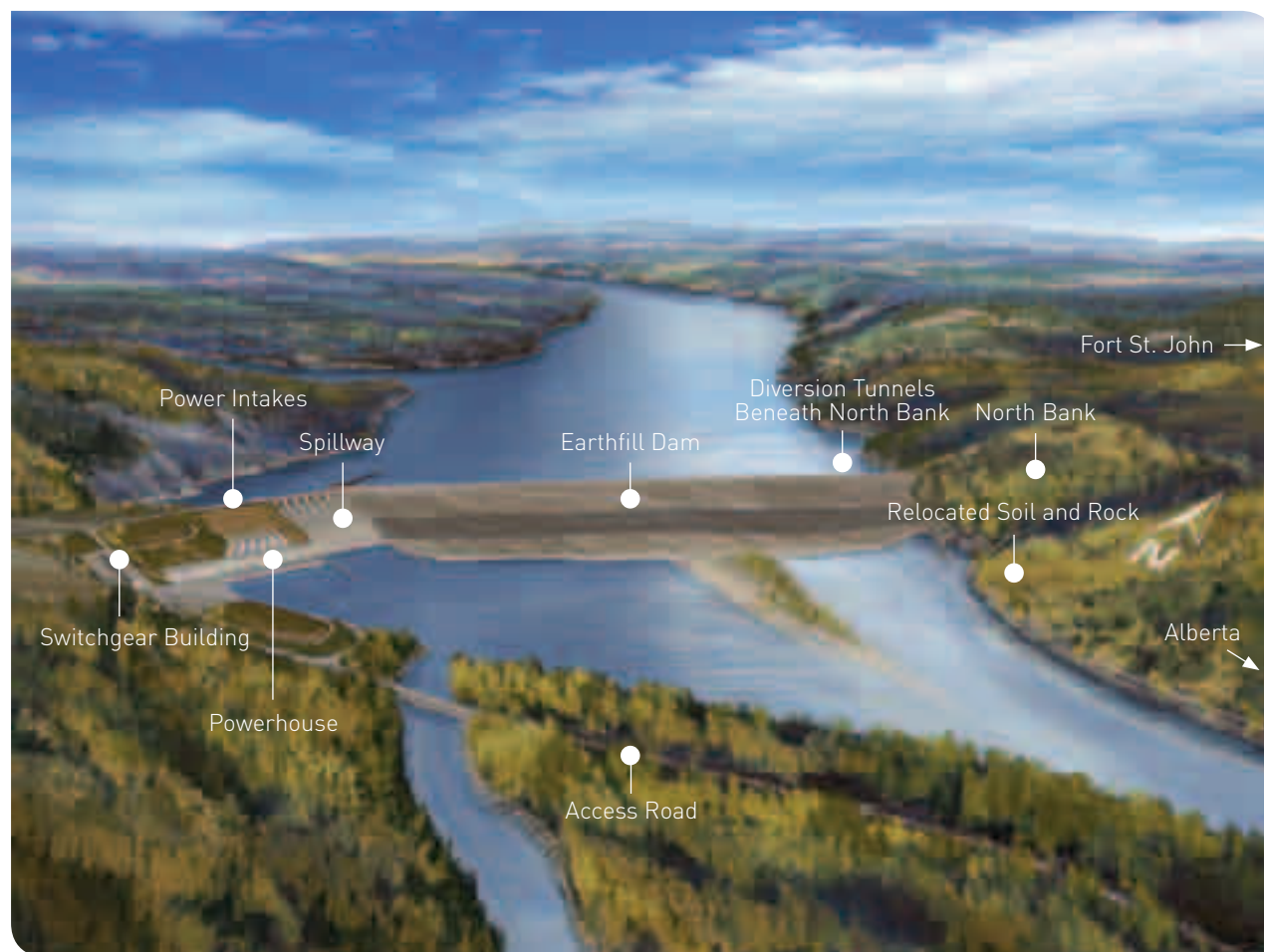
In 2007, the Canadian Dam Association (CDA) issued new guidelines for dam safety in Canada. During the 1981 design and 1989 review of the Site C project, no such Canadian guidelines existed. As a result, technical studies and analysis were initiated during Stage 2 to ensure that the Site C design, as conceived in the 1980s, would meet or exceed these new guidelines.

The Site C design from the 1980s is an earthfill dam approximately 1,100 metres in length, with about 300 metres of concrete structures on the south bank consisting of the spillway, power intakes, penstocks and powerhouse (see Figure 6-1). The reservoir would be about 83 kilometres long with a total shoreline length of about 280 kilometres, including partial flooding of the Moberly and Halfway rivers, and Cache and Lynx creeks.

The earthfill dam, spillway headworks, power intakes and associated training walls are the main reservoir water-retaining structures.¹⁷ Design and construction must ensure that these structures are able to withstand the normal loads of the dam and reservoir, as well as extreme loads resulting from potential floods and earthquakes.

¹⁷ For a more in-depth description of the major components of Site C, see Chapter 4 of the *Site C Feasibility Review: Stage 1 Completion Report*, December 2007.

FIGURE 6-1: MAJOR COMPONENTS OF THE POTENTIAL SITE C DAM (HISTORIC CONCEPTUAL DESIGN)



6.4.1.1 CONSTRUCTION SEQUENCE AND RIVER DIVERSION

As described in the Stage 1 report, the basic sequence of construction and river diversion, developed in the 1980s, would require a seven-year construction period. It would consist of four main activity periods: pre-diversion work, river diversion work, reservoir filling, and commissioning of the generating units.

The basic sequence is described below.

<p>1. Pre-diversion work</p>	<ul style="list-style-type: none"> • To provide access to the south bank, a new crossing of the Peace River would be built downstream of the dam. Clearing of the dam site and development of the worker camps would also be conducted in the first year of construction. • Cofferdams (temporary dams to allow dewatering of work areas) would be constructed on the north bank at either end (upstream and downstream) of the two diversion tunnels to isolate the areas from the river and allow construction of the two tunnels. Following completion of the tunnels, the cofferdams would be removed and the river would be diverted through the tunnels using additional cofferdams built across the river channel upstream and downstream of the earthfill dam foundation area. A review of the floods used to size the tunnels and temporary cofferdams was initiated in Stage 2.
<p>2. River diversion work</p>	<ul style="list-style-type: none"> • The Peace River would be diverted for about 46 months. During this period, the excavations, earthfill dam, concrete structures, and first two generating units would be completed.
<p>3. Reservoir filling</p>	<ul style="list-style-type: none"> • The filling of the reservoir would begin in the sixth year of construction and would take approximately one month, depending on the requirements for staged filling.
<p>4. Commissioning of generating units</p>	<ul style="list-style-type: none"> • The remaining generating units and completion of construction activities would occur over the final 15 months.

If the project were to advance, additional project optimization would be required to determine the most appropriate construction and diversion sequence.

6.4.1.2 MAXIMUM DESIGN EARTHQUAKE

Maximum Design Earthquake (MDE) is the level of earthquake ground motion for which a dam structure is designed. In the early design phase, up until about 1990, the seismicity of the Peace River region was considered to be very low and earthquake loads did not greatly affect the design of the project. Since that time, however, a cluster of small earthquakes have been recorded just north of Fort St. John, and a magnitude 5.4 earthquake occurred in 2001 near Dawson Creek, about 70 kilometres from the potential Site C location.

With a new understanding of the seismicity of the region, a seismic hazard assessment was completed during Stage 2. Results of this work indicate that the Maximum Design Earthquake at Site C is larger than previously considered.

Stage 2 analysis suggests that the proposed Site C design has to be refined to withstand new MDE loads: for example, by contouring the north bank slope above the earthfill dam to a flatter slope, reinforcing the foundation of the spillway headworks, buttressing the power intakes and penstocks, and providing extensive drainage measures beneath the spillway and power intakes.



Peace River shoreline upstream from Bear Flat (July 2009).

6.4.1.3 FOUNDATION REBOUND

Due to the geology in the area of the potential dam, the foundation rock is susceptible to short-term and long-term swelling (called rebound) as well as deterioration when excavated and/or exposed to water and air.

Short-term swelling due to the removal of the weight of soil during excavation and the deterioration on exposure would be addressed during construction with careful foundation treatment and construction planning. In addition, the design of the structures would have to consider long-term swelling, which may occur over decades. Long-term swelling can occur if the weight of the structure (powerhouse, intakes, spillway and dam) is less than the weight of rock and soil excavated to reach the foundation of the structure. The majority of the concrete structures on the south bank are susceptible to rebound due to the depth of excavation.

During Stage 2, field and laboratory investigations were initiated to help determine the potential scope of the rebound issue. While Stage 2 work incorporated the potential effects of rebound on the power intakes, spillway and powerhouse, further sampling and testing of the rock and analysis of the interaction between the foundation and power intakes, spillway and powerhouse are recommended if the project proceeds to the next stage.

6.4.1.4 PORE PRESSURE RESPONSE

Fractures in the foundation rock parallel to the sedimentary bedding layers (called bedding planes) and cross-cutting shears present challenges for the design of Site C. The project design would need to compensate for a temporary rise in water pressure along the relatively weak bedding planes due to the increasing load imposed by construction of the dam, a phenomenon described as “induced pore pressures”.

These pressures would need to be taken into account in the final design of the dam to avoid any delay in construction. Additional field tests were initiated during Stage 2 to help determine the expected magnitude of induced pore pressures. However, further field, laboratory and analytical work to predict the behaviour of the foundation and account for the induced pore pressures in the design is required.

6.4.1.5 CONSTRUCTION MATERIAL SOURCES AND RELOCATION OF EXCESS EXCAVATED MATERIALS

Construction of the temporary and permanent dam facilities would require a considerable volume of earth and rock materials. In addition, excavations would be required for construction of the dam, spillway, power intakes and powerhouse. Much of this material would be unsuitable for construction and would need to be relocated.

A diagram of the potential earthfill dam at Site C is shown in Figure 6-2. Impervious material such as glacial till would be used to construct Zone A, the core of the dam. Filter zones consisting of sand (Zone B) and fine gravel (Zone C) would isolate the impervious core from the granular materials (mainly sand and gravel) that form the shells of the dam (Zone D). The filter zones protect against seepage carrying the fine material from the core of the dam into the shell.

The upstream and downstream cofferdams would be incorporated into the earthfill dam. The space between the upstream cofferdam and the upstream shell of the dam would be filled with surplus materials from the excavations required to construct the project structures. The upper part of the upstream face of the dam would be protected from wave erosion by coarse rock riprap (Zone F) on a bedding of fine rock (Zone E).

The majority of materials necessary for construction of an earthfill dam (Zones B, C, D and E) are available in the vicinity of Site C. However, Zone F coarse rock riprap would likely be imported from a quarry in the Rocky Mountains. Alternatively, erosion protection manufactured from concrete could be used.

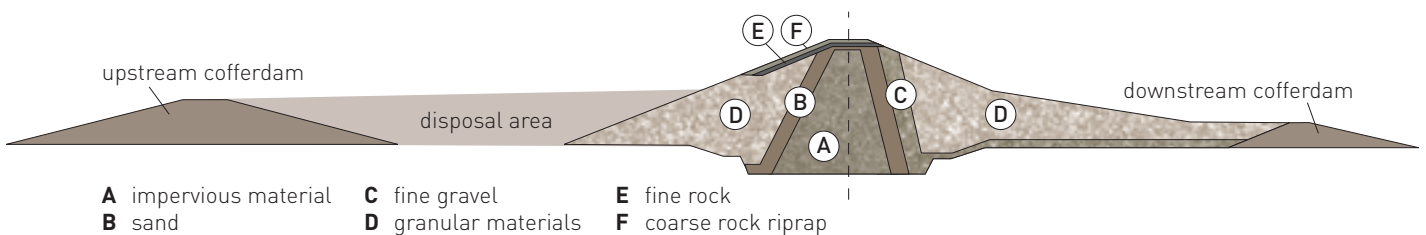
It is believed that Zone A material (glacial till) for the impervious core (the primary water flow barrier) can be found within 10 kilometres of the potential dam site. The historic design assumed the impervious fill material would come from the extensive excavations required on the north bank to complete dam construction. However, in 1989, further studies determined that materials located on the north bank are not suitable for use as impervious fill. This finding was confirmed in Stage 2.

If the project advances to the next stage, work to identify the best option for impervious fill material and related extraction and transportation details would continue.

Excavations would be required during construction to accommodate the Site C dam infrastructure and to stabilize slopes at the dam site. Excavated material would be used for dam construction, wherever possible, and the rest would be relocated. Soil and rock relocation areas would be reclaimed progressively and, where feasible, reclamation would include the construction of habitat features for wildlife, such as rock piles, ponds, wet depressions and contoured ground, debris piles, potential den sites, nest platforms, coarse woody debris, and snags. Any relocated soil and rock placed along the river banks would be contained by dikes constructed from gravel to prevent sedimentation of the river.

Flattening of the north bank slope to allow for the larger Maximum Design Earthquake increases the amount of surplus excavated material. A preliminary relocation plan for this surplus material was developed in Stage 2.

FIGURE 6-2: CONSTRUCTION MATERIALS FOR THE SITE C DAM



6.4.1.6 PROBABLE MAXIMUM FLOOD

Stage 2 engineering work confirms that the proposed Site C spillway is large enough to safely pass the Probable Maximum Flood (PMF), which is the flood that could occur with the most severe combination of weather and hydrologic conditions.

During Stage 2, the Probable Maximum Flood was reassessed, which included a review of the current operations of G.M. Shrum and Peace Canyon, as well as climatic data and flow records for the Peace, Halfway and Moberly rivers. These studies included a preliminary sensitivity analysis to determine possible effects of climate change.

If the project proceeds to the next stage, options would be assessed for conversion of the diversion tunnels to low-level discharge facilities to reduce the required capacity of the spillway and provide flexibility for reservoir operations.

6.4.1.7 HOUSING FOR WORKERS

As discussed in the Stage 1 report, according to previous estimates, approximately 7,650 person-years of work would be required to complete the project, with the labour force peaking at approximately 2,000 in year four of construction.

In its base design from the 1980s, BC Hydro assumed that 75 per cent of the workers would be housed in two construction camps located close to the dam construction site, and the remainder of the workers would either come from the local area or find accommodation off-site. However, as part of the public consultation conducted in Stage 2, some stakeholders expressed concern that housing workers in construction camps could put pressure on local infrastructure — such as schools, health care, recreation facilities and policing — without providing any benefits to municipalities. Other stakeholders expressed concern about the short-term nature of the worker housing requirements and its potential impact on the local housing market and local services.

BC Hydro recognizes that the housing of the construction workers is a significant issue for local municipalities and that it has the potential to leave a lasting legacy in the region. Should the project proceed, BC Hydro would further review potential options for worker housing and consult with local stakeholders to review the advantages and disadvantages of each option.



Williston Reservoir from above the W.A.C. Bennett Dam.

6.4.2 RESERVOIR AND OPERATIONS

6.4.2.1 RESERVOIR CLEARING

Preliminary baseline timber harvest and clearing considerations were developed and reviewed in Stage 2. If the Site C project advances to the next stage, an integrated reservoir preparation plan would be developed, which would consider potential socio-economic impacts, heritage resources, air quality, and fish and wildlife habitats.

Activities such as clearing and removal of timber and vegetation, localized shoreline protection and preparation, recreation site development, and the creation of fish and wildlife habitats would occur prior to filling the reservoir.

A Stage 2 review of reservoir clearing shows that clearing could occur over a seven-year period before and during construction. In general, woody vegetation in the reservoir area below the maximum normal operating level would be cleared. If the project proceeds to Stage 3, studies would be conducted to help understand the trade-offs between clearing to reduce greenhouse gas emissions and leaving some vegetation in place that could be beneficial for fish and wildlife habitat, shoreline stability and water quality. For example, to minimize the potential for erosion before and after reservoir filling, and to maintain habitat complexity and soil structure, low stumps would likely be retained except where they may pose a public safety risk, or hinder boating or fishing activities.

It is estimated that within the project area there would be roughly 1,000,000 cubic metres of merchantable timber that could be harvested and approximately 550,000 cubic metres of waste vegetation. It is expected that mills in the region could handle the timber volumes over multiple years without significantly affecting operations. BC Hydro would continue to work with the provincial government and local forest licensees and facilities to maximize the use of merchantable timber while minimizing disruptions to the local forestry industry.

A waste vegetation plan would be refined in the next stage, following further feasibility analysis and consultation with local communities, First Nations, stakeholders and regulators. Consistent feedback from Stage 2 stakeholder consultations indicated that, regarding reservoir clearing, the top priorities for participants include minimizing visual impacts, health impacts and local impacts, followed by a desire to minimize greenhouse gas emissions.

Every effort would be made to find an economical use of waste vegetation. Any disposal of waste would be performed in accordance with provincial and federal regulations and would be designed to minimize air quality impacts. Alternatives such as chipping, composting, reuse or conversion of waste to bioenergy would also be explored to mitigate greenhouse gas emissions during reservoir preparation.

Most reservoir preparation activities would require the construction or upgrading of roads on both sides of the reservoir and dam site. As currently conceived, these roads would be decommissioned following the clearing activities. Feedback during the Stage 2 public consultation indicated that a majority of participants favoured increased access to the north and south banks of the reservoir (65 per cent and 59 per cent respectively). Therefore, increased access for recreation and other activities would need to be considered with respect to the conservation goals of the region.

If the project proceeds to Stage 3, it would include an effects assessment of access roads for reservoir clearing.

6.4.2.2 RESERVOIR SHORELINE CONDITIONS AND IMPACT LINES

The International Commission on Large Dams (ICOLD) published guidelines for the assessment of reservoir shoreline stability in 2002. These guidelines have been incorporated into the assessment of potential shoreline impacts, detailed below.

Creation of the Site C reservoir would have several different impacts on land adjacent to the reservoir. Stage 2 public and stakeholder consultation participants indicated that the residents of the Peace River are aware of and concerned about how reservoir shoreline conditions — such as erosion and stability — might affect issues such as public safety, property use, recreation and the environment.

During Stage 2, a modern impact lines approach, consistent with the ICOLD guidelines, was adopted to assist in a further assessment of erosion and stability. Preliminary impact lines are being established to outline areas potentially affected by flooding, slope stability, wave erosion, groundwater, and slide-generated waves. The previously established “safeline” approach has been replaced, as it was restricted to residential land use and did not specifically address the various physical impacts of the reservoir.

The main objectives of the new impact line approach are to:

- Allow flexibility for land use adjacent to the reservoir, such as allowing grazing in areas that would not be suitable for residential use.
- Use international best practices to define the different shoreline processes and provide estimates of the impacts of the reservoir, including time-dependent processes such as erosion.

The same methodology would be used to assess the condition of the existing river valley and shoreline upstream from Site C to define the current natural state. The impact of the proposed reservoir would be the difference between the natural state and the state that would exist after the reservoir has been flooded.



Shoreline of the Peace River upstream from Bear Flat.

The physical processes that determine reservoir impacts have inherent uncertainties that need to be understood and accounted for when establishing reservoir impact lines. Some particularly sensitive regions may require further investigation, should the project proceed. Finally, should the Site C project advance to construction, the impact lines may be adjusted based on the actual shoreline impacts, which would be closely monitored during construction, reservoir filling and operation.

The impact lines would have implications for zoning and property requirements, and for easements for the project, as well as for defining local boundaries to assess environmental and socio-economic impacts.

The government agencies responsible for regional zoning and the Ministry of Transportation and Infrastructure, responsible for Highway 29, would be consulted on the results of the impact lines assessment, if the project advances to the next stage. In addition, individual property owners would be consulted on the preliminary results of the impact lines assessment to identify areas that could warrant site-specific investigations and assessment due to sensitive areas or property owner concerns.

The term impact line refers to a boundary beyond which lands adjacent to a reservoir are not expected to be affected by the creation or normal operation of the reservoir. Five impact lines related to flooding, stability, erosion, groundwater, and landslide-generated waves are envisioned. These impact lines are defined below:

FIGURE 6-3: FLOODING IMPACT LINE

The Flooding Impact Line is defined as the boundary beyond which the land adjacent to the reservoir is not expected to be flooded as a result of the creation or normal operation of the reservoir.

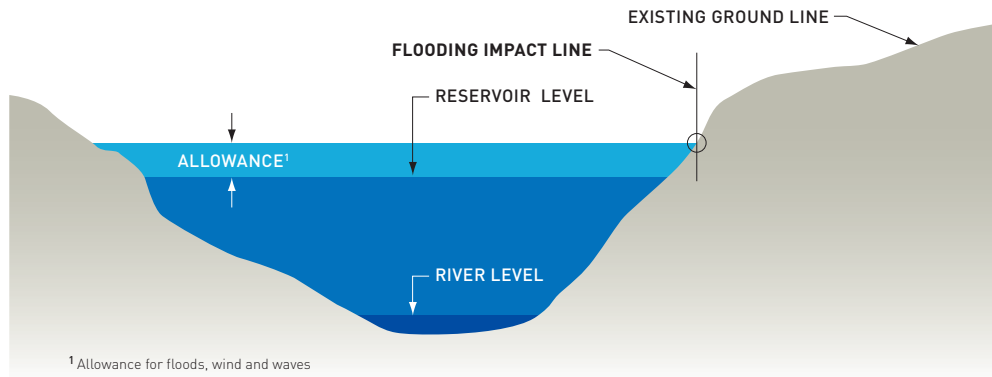


FIGURE 6-4: STABILITY IMPACT LINE

The Stability Impact Line is defined as the boundary beyond which the land adjacent to the reservoir is not expected to be affected by landslides resulting from the creation or normal operation of the reservoir.

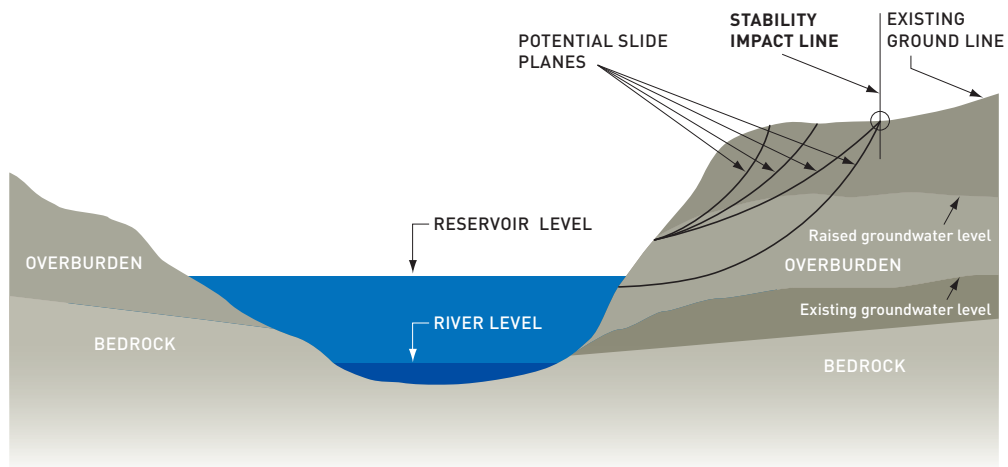
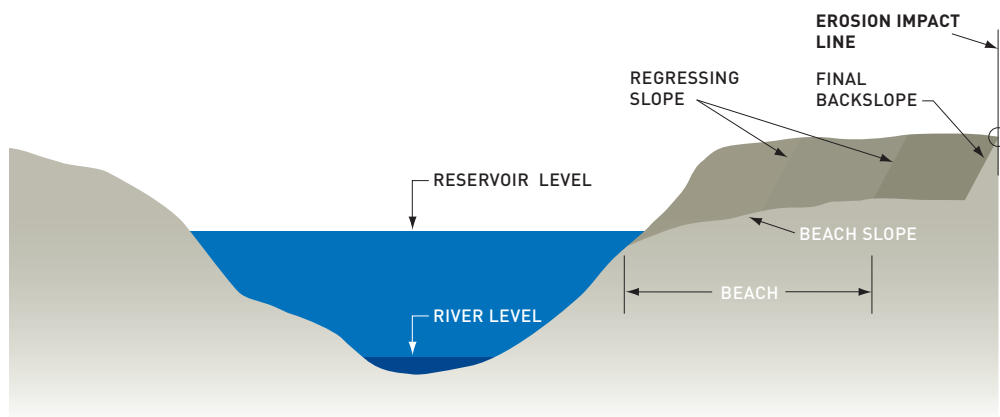
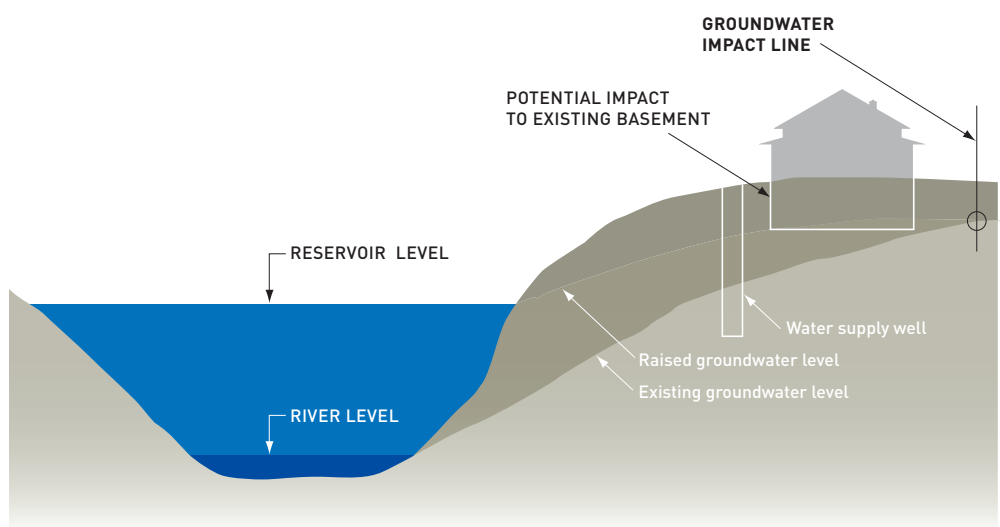


FIGURE 6-5: EROSION IMPACT LINE

The Erosion Impact Line is defined as the boundary beyond which the land adjacent to the reservoir is not expected to be affected by progressive shoreline erosion and regression as a result of the creation or normal operation of the reservoir.

**FIGURE 6-6: GROUNDWATER IMPACT LINE**

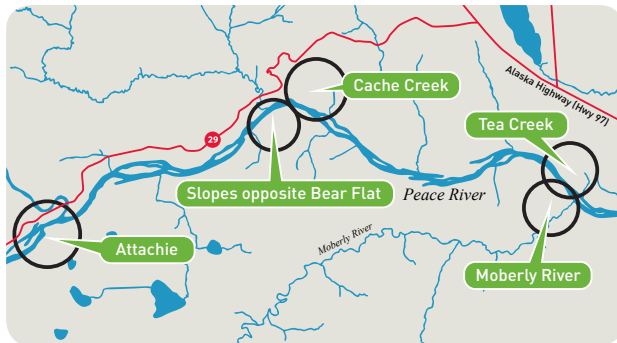
The Groundwater Impact Line is defined as the boundary beyond which groundwater levels in the land adjacent to the reservoir are not expected to be affected by the creation or normal operation of the reservoir.



LANDSLIDE-GENERATED WAVE IMPACT LINE

The Landslide-Generated Wave Impact Line is defined as the boundary beyond which the land adjacent to the reservoir is not expected to be affected by waves generated by a landslide into the reservoir. The dam is designed to safely accommodate the largest possible wave that could be created by a landslide into the reservoir.

FIGURE 6-7: LANDSLIDE-GENERATED WAVE IMPACT LINES



This graphic illustrates the areas in the Peace River valley that have been investigated to help determine their potential for producing landslide-generated waves.

The impact lines established during Stage 2 are preliminary due to the inherent uncertainty in the physical processes and because of the uncertain geological conditions. This is particularly the case in areas where the in situ material has been covered by vegetation and/or material that has slid down the slope so that the underlying geology cannot be seen. Should the project move forward, the impact lines would be revised using the results of slope monitoring, additional regional geological investigations, wind data in the valley and, where appropriate, site-specific investigations such as drilling and trenching.

6.4.2.3 HUDSON'S HOPE SHORELINE PROTECTION



Bank of the Peace River at Hudson's Hope.

The slopes below Hudson's Hope comprise both erodible material and more resistant bedrock. Flooding the reservoir would result in a change in the groundwater condition that, when coupled with the effects of beaching from erosion, would cause some shoreline regression. As a result, a berm was proposed as part of the 1980s design to protect the residential portions of the shoreline and the sewage lagoons where the shoreline is erodible.

The preliminary results of Stage 2 studies have verified that parts of the shoreline at Hudson's Hope are erodible. Therefore, shoreline protection at Hudson's Hope would need to be incorporated into the project.

If the project proceeds, the detailed design features and extent of shoreline protection would be assessed.

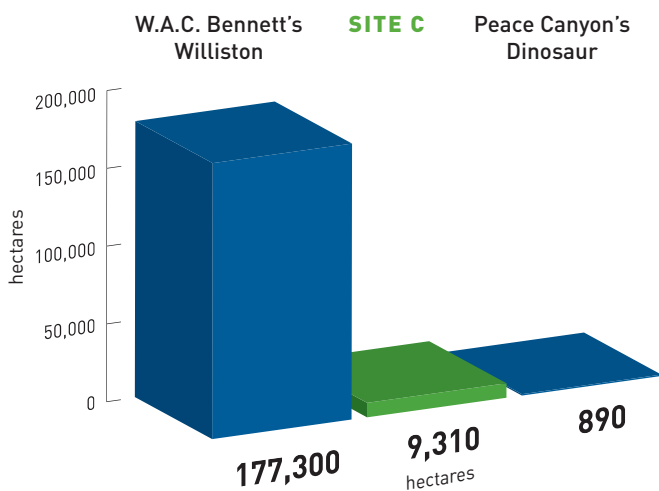
6.4.2.4 RESERVOIR OPERATIONS

The Site C reservoir would be comparatively small relative to BC Hydro's other reservoirs, as it would rely on the storage capability of the large Williston Reservoir upstream. The Site C facility would generate roughly 30 per cent of the power of the W.A.C. Bennett facility upstream, with just five per cent of the reservoir area. Because Site C would rely on the Williston Reservoir for water storage, normal downstream flows are expected to change very little if the project is constructed.

BC Hydro has proposed a normal operating water level range in the Site C reservoir of 1.8 metres. Based on this operating range and current expectations of the requirements on the B.C. electrical system, the potential Site C reservoir would have relatively little fluctuation in water levels. In exceptional circumstances, such as extreme rainfall in the local watershed, the Site C reservoir could rise above the normal maximum reservoir level. The reservoir could also be drawn down to lower levels for system emergencies.

The recommendation on reservoir operations will ultimately be based on additional engineering, environmental and socio-economic studies, as well as consultation with communities and First Nations. These recommendations must then be approved by the B.C. Comptroller of Water Rights as part of the water licensing process.

FIGURE 6-8: RESERVOIR COMPARISON



6.4.2.5 DOWNSTREAM WATER FLOWS, SEDIMENT AND ELEVATIONS

As part of Stage 2, BC Hydro looked at sample operations scenarios to provide a preliminary understanding of the potential downstream effects associated with Site C. Preliminary study results associated with downstream flows, water elevations, sediment transport and geomorphology (riverbed forms and processes that shape them) suggest that there would be relatively few notable changes during normal operations, beyond those within the immediate project area a few kilometres downstream of the dam. If the Site C project were to proceed, additional studies would be required to further refine these predictions; however, preliminary results are briefly described below.

The Site C dam, similar to the Peace Canyon Dam and other facilities in B.C., would be operated to follow provincial electricity demand. The current time for travel of water from Peace Canyon to the proposed Site C location is 10 to 12 hours. This means that if Site C was constructed, a change in flows due to a change in system requirements would occur 10 to 12 hours earlier than under existing conditions.

Downstream at the district of Taylor, preliminary results, based on optimizing power production, suggest generally less than half a metre change in the 24-hour minimum and maximum river elevations from the current river fluctuations. As major tributaries downstream flow into the Peace River, these flow and elevation changes would be further dampened with increasing distance from the Site C dam. At the Peace-Athabasca Delta approximately 1,100 kilometres downstream, no significant flow or water level differences are expected.



Peace River looking downstream towards Taylor.

If Site C were to proceed, the sediment currently contributed to the Peace River from the reservoir area (between Peace Canyon Dam and Site C) is expected to be trapped in the reservoir. This would not impact the planned operations of the dam. In addition, under normal operating circumstances, these changes to the sediment load are not expected to have notable impacts on the river channel downstream. This is because the significant sediment loads from downstream tributaries (i.e., the Pine, Beatton, etc.) would not be affected and the flow regime would change very little from today under normal operating conditions – thus, riverbed material would not be mobilized in quantities significantly different from today. Additional studies would need to be performed to refine the understanding of sediment transport under normal operations and during flood events and/or during potential routine testing of the spillway.

6.4.2.6 DOWNSTREAM ICE

The Peace River flows generally northeast, and eventually empties into the Arctic Ocean. Each year, ice forms on the Peace River and moves upstream through Alberta towards the proposed Site C location. This ice cover can affect water levels in the river, and is used for transportation via ice bridges at various sites along the river. During the spring breakup, ice floes can build up and “jam”, which increases the probability of flooding in some reaches of the river. BC Hydro is a participant in the Alberta-B.C. Joint Task Force on Peace River Ice, and works to manage winter and spring flows on the Peace River to reduce the probability of flooding from ice jams at the town of Peace River, Alberta.

Hydroelectric facilities on rivers can change ice conditions by creating a barrier that gathers ice on the upstream end of the dam and pushes an ice front upstream and/or by changing the temperature of the water flowing downstream, which reduces or promotes ice formation, depending on whether the water is warmer or cooler during the winter months.

At present, in any given year, there is approximately a 50 per cent chance of an ice front crossing into B.C. from Alberta. It extends upstream as far as the district of Taylor roughly 20 per cent of the time. However, an ice front has not reached Taylor since 1996 due to milder winter temperatures.

Both the Site C dam and Alberta’s proposed Dunvegan Hydroelectric Project would change ice formation in the Peace River if either or both were to proceed to construction. If the winter water temperatures are warmer than current conditions at the proposed Site C location, there would be a reduced frequency of spring ice jamming associated with the Smoky River breakup at the town of Peace River. If the winter water temperatures are cooler, ice breakup may occur later in the year. There may also be an effect on the formation and use of ice bridges downstream of the project.

Additional water temperature modelling of the proposed Site C reservoir would be required, if the project advances, to further refine our understanding of the changes to ice formation downstream.

6.4.3 ROADS AND BRIDGES

6.4.3.1 POWERHOUSE ACCESS AND PEACE RIVER CROSSING

As part of the Site C project, a bridge would be required across the Peace River to provide access to the Site C powerhouse, as shown in Figure 6-9.

Existing road networks on the south bank of the Peace River include the partially paved Jackfish Lake Road and an unpaved network of rail, transmission, oil and gas, and forest service roads. The roads and bridges required for Site C, which would require some upgrading, could connect with these existing unpaved industrial roads on the south side of the Peace River and with the Fort St. John municipal road network on the north side of the river. Vehicle use on the road would range from large construction equipment to smaller commuter vehicles. If the project were to advance to the next stage, a traffic management plan would be developed in consultation with the Ministry of Transportation and Infrastructure, local governments, stakeholders, First Nations and the public.



Jackfish Lake Road looking north towards Fort St. John.

FIGURE 6-9: POWERHOUSE ACCESS AND PEACE RIVER CROSSING



BC Hydro was asked during Pre-Consultation to discuss the merits of public access to this new bridge. A design update on the powerhouse access bridge and associated road network has been completed as part of Stage 2 in accordance with Ministry of Transportation and Infrastructure standards for a public two-lane, low-volume road. However, other than access to the railway at Septimus Siding, any upgrade or extension to the road network on the south bank, such as the Jackfish Lake Road or network of industrial roads, are outside the current scope of the Site C project.



Above Septimus Siding on the south bank of the Peace River.

During public consultation in Stage 2, the majority of participants expressed the opinion that, if a new bridge is constructed as part of the Site C project, they would like it to be accessible to the public after construction. However, some participants expressed concerns about the need to restrict access to promote conservation and to avoid the potential socio-economic impacts of bypassing Hudson's Hope and Dawson Creek.

Prior to any decision on public access, further consultation with the Ministry of Transportation and Infrastructure, local governments, stakeholders, First Nations and the public would be undertaken. In addition, studies to assess the potential environmental and socio-economic effects of public access and traffic patterns would be required if the project proceeds to the next stage.

6.4.3.2 RELOCATION OF FOUR SEGMENTS OF HIGHWAY 29

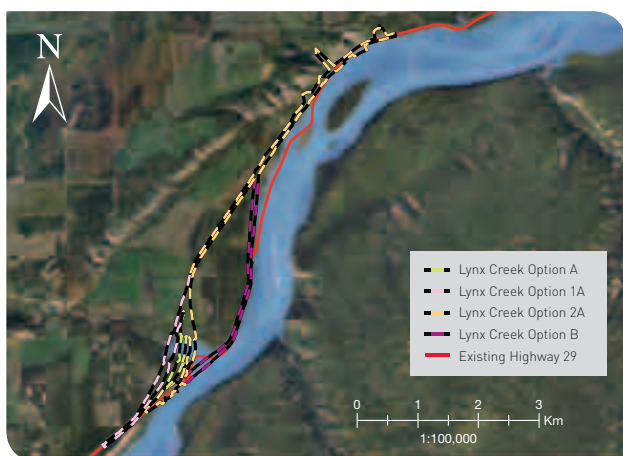
Four segments of Highway 29 would be flooded by the reservoir if Site C were to proceed. During Stage 2, the historically identified realignment options for each relocated segment were updated to current Ministry of Transportation and Infrastructure design standards.

Relocations of the four updated segments that were envisioned in the 1980s historic project are illustrated in Figure 6-10. The realignment of approximately 25 kilometres of Highway 29 would be required in the Cache Creek (Bear Flat), Halfway River, Farrell Creek and Lynx Creek areas. Two types of water crossings were considered for each of the alignments: a short concrete bridge supported on piles with a long embankment, and a long concrete bridge supported on piles with a short embankment.

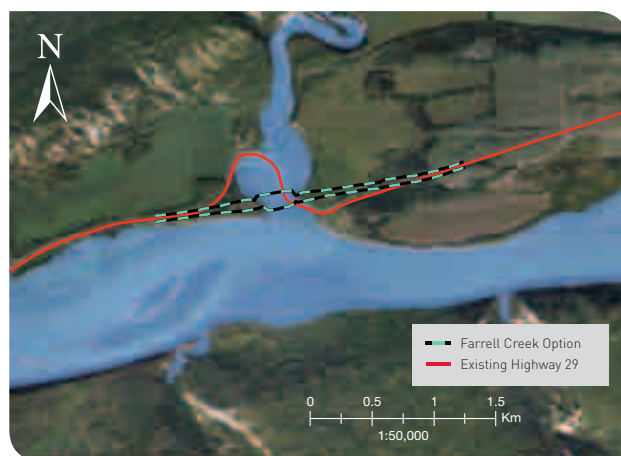
Further consultation and study would be required to determine feasibility, potential impacts on private property, the environment and heritage resources if the project were to proceed.

Through consultation with property owners, potential alternative routings were identified along existing roads and rights-of-way and in areas outside of the historic options. In addition, concerns regarding slope stability, wildlife protection, access and other impacts were raised. This property owner input would be incorporated into the assessment if the project were to proceed.

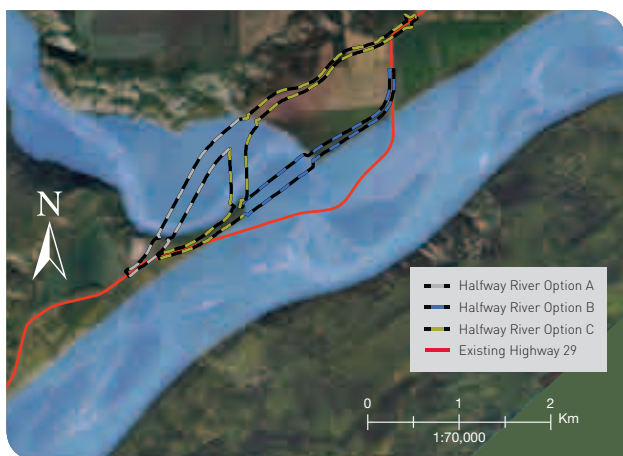
FIGURE 6-10: HIGHWAY 29 REALIGNMENT OPTIONS



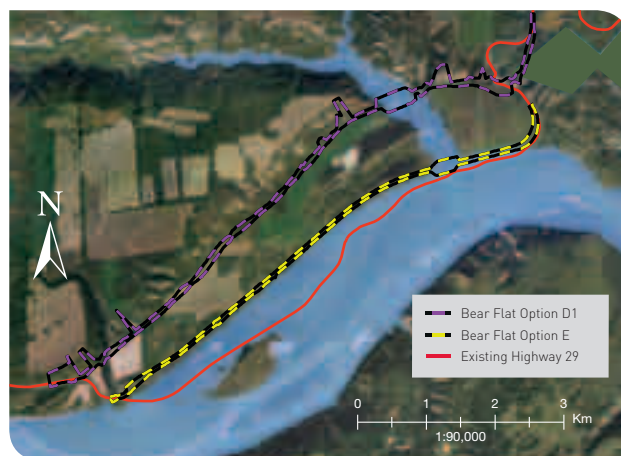
Potential Highway Realignment – Lynx Creek Segment



Potential Highway Realignment – Farrell Creek Segment



Potential Highway Realignment – Halfway River Segment



Potential Highway Realignment – Bear Flat Segment

6.4.4 TRANSMISSION REQUIREMENTS

The British Columbia Transmission Corporation (BCTC) is responsible for planning, operating and managing the transmission system owned by BC Hydro. For Site C, BCTC is responsible for planning system requirements associated with the interconnection at the Peace Canyon substation.

As discussed in the Stage 1 Report, BCTC prepared a transmission study in 2004 that evaluated the potential transmission requirements to connect Site C to provincial load centres based on the actual and forecast loads and resources at that time. Based on this study, upgrades to the series capacitor station and the addition of static volt-ampere-reactive (VAR) compensators at points in the B.C. transmission system would be required for Site C, but no new transmission lines would be required.

As part of the work in Stage 2, BC Hydro commissioned BCTC to update the forecast of potential transmission requirements beyond the interconnection at the Peace Canyon substation

based on the updated forecast of loads and resources prepared as part of BC Hydro's 2008 Long-Term Acquisition Plan. This update confirms that upgrades to existing equipment would be the most cost-effective option for integrating Site C generation, and that no new transmission lines would be required to bring Site C energy to the Lower Mainland. However, these transmission requirements would be evaluated in conjunction with reviewing other potential new electricity generation from the north, which could include wind or other renewable projects. BCTC would conduct this evaluation as part of its province-wide transmission planning.

If the Site C project proceeds, two 500 kilovolt (kV) transmission lines would travel from the Site C switchyard to the Peace Canyon substation along an existing right-of-way. This right-of-way is currently used by two 138 kV transmission lines and would put the 500 kV lines alongside, requiring a widening of the right-of-way by about 34 metres.



Transmission lines connected to the Peace Canyon Dam (July 2009).

6.5 NEXT STEPS

As would be expected, there have been many changes in guidelines and construction practices since the majority of the design work and key design choices were made in the late 1970s and 1980s. These changes range from guidelines for the construction of hydroelectric facilities and environmental considerations to new information on fundamental foundation and seismic conditions. In addition, relative costs of construction activities, such as concrete works versus earthworks, have also changed.

As a result of Stage 2 engineering work, BC Hydro has concluded that a refined and updated design is required to meet current seismic, safety and environmental guidelines and to incorporate input from consultation. This optimization work means design refinements and updating may produce design solutions that provide a better balance between risk, cost and environmental considerations.

ADDITIONAL INFORMATION

The following reports were conducted during Stage 2 on engineering and operations. The studies below are available at www.bchydro.com/sitec.

Peace River Site C Hydro Project – Stage 2 Engineering Services Summary Report. Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.

Peace River Site C Hydro Project – Highway 29 Relocations. Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.

Peace River Site C Hydro Project – Powerhouse Access Road & Bridge. Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.

Peace River Site C Hydro Project – Reservoir Shoreline Impacts: Methodology and Criteria. Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.

Peace River Site C Hydro Project - Stage 2 Preliminary Clearing Considerations. Industrial Forestry Service Ltd. 2009.

Peace River Site C Hydro Project - Stage 2 Review of Potential Downstream Changes from Site C Operations – Preliminary Findings. BC Hydro. 2009.

FINANCIAL UPDATE ON SITE C

As part of Stage 1 work, BC Hydro produced a preliminary interim cost estimate in 2007 based on the historic design of the project from the 1980s. The interim project cost estimate at the end of Stage 1 was \$5.0 to \$6.6 billion. This estimate was based on the historical design outlined in the Stage 1 report, and used detailed quantities and escalated pricing from a previous BC Hydro analysis of the project.

Interim cost estimates are useful in comparing the project to alternatives under consideration today and making a decision on whether it is prudent to investigate the project further. However, there is always uncertainty associated with interim cost estimates as there may be changes to project scope, schedule, and/or market factors prior to a decision to begin construction.

If the project advances to Stage 3, the interim cost estimate would be updated to reflect current market conditions such as commodity prices, and labour prices. In addition, the historical project design is almost 30 years old

and would also be updated to reflect current environmental, seismic and safety guidelines, as well as input from public consultation. Due to the increases in modern design and seismic standards, BC Hydro believes these design changes would increase the total project cost. However, compared to alternatives, Site C would still be among the most cost-effective options to meet future electricity needs in B.C.

While it is possible for BC Hydro to produce a cost estimate based on the 1980s design, it is not prudent to do, since potential design changes resulting from optimization would impact the capital cost estimate. Providing for these potential design changes at this point may produce a cost range that is so variable it would not be meaningful to decision makers. An updated interim project cost estimate based on a refined and optimized project design will be completed if the project advances to Stage 3. This would provide a meaningful representation of project costs for Site C.

7.0 ENVIRONMENT AND SOCIO-ECONOMIC

CHAPTER HIGHLIGHTS

- During Stage 2, BC Hydro set out to identify potential issues and characterize the current physical, biological and socio-economic environment in the potential Site C project area.
- Environmental and socio-economic studies — primarily baseline surveys — were completed for the following topics:
 - Fish and aquatic habitat
 - Vegetation and wildlife
 - Water quality
 - Local climate and greenhouse gas emissions
 - Heritage
 - Community services and infrastructure
 - Economic
 - Land use and resources
- Based on this work, BC Hydro has built on its historic understanding of issues and current conditions in the potential project area. Should the project proceed to an environmental and regulatory review, technical studies would advance from baseline work to effects assessment, which would determine the potential effects of the project, and identify ways to avoid or minimize undesirable effects and enhance desirable effects.

This chapter provides an overview of BC Hydro's work during Stage 2 on environmental and socio-economic topics. The emphasis of the work was to identify potential issues, and to complete baseline studies to describe existing conditions and identify data gaps.

7.1 BACKGROUND

Considerable analysis has been conducted prior to Stage 2 on the environmental and socio-economic conditions and effects of the potential Site C project. In 2007, the *Site C Feasibility Review: Stage 1 Completion Report* presented a broad overview of potential environmental and socio-economic topics and project effects based on studies conducted in the late 1970s to early 1990s, and noted that most of these studies required updating.

The Stage 1 report provided a broad overview of local environmental and community topics, including potential project effects based on past work on the Site C project. During consultation with the public and First Nations, BC Hydro learned more about the importance of these values to people and communities.

In Stage 1, several baseline studies were initiated on fish, wildlife and water quality, in areas where multiple years of study would be required. The program expanded in Stage 2 to include areas where data gaps may exist or where early data collection supported other study areas (e.g., climate and water temperature models).

Based on this work, BC Hydro has built on its historic understanding of issues and current conditions in the potential project area. Should the project proceed to an environmental and regulatory review, technical studies would advance from baseline work to effects assessment, which would determine the potential effects of the project, and identify ways to avoid or minimize undesirable effects and enhance desirable effects.



The city of Fort St. John and the Peace River.

ENVIRONMENTAL AND REGULATORY REVIEW

If the Site C project were to advance to Stage 3, it would include an independent environmental and regulatory review. Environmental and regulatory reviews of Site C would include opportunities for consultation and input by the public, First Nations, stakeholders, communities and customers. In general, environmental assessment is a process to assess the effects of a project before it is carried out.

Generally, environmental assessments include:

- Opportunities for interested parties to identify issues and provide input regarding the factors that should be considered in the environmental assessment.
- Technical studies of the potential environmental, social, economic, heritage and health effects of the proposed project.
- Identification of possible ways to prevent or minimize undesirable effects and enhance desirable effects, and analysis to predict residual environmental effects including mitigation.
- Consideration of input from interested parties in compiling the assessment findings, and in making recommendations about project acceptability.

Both the federal and provincial environmental assessment processes review proposed projects and assess their potential effects and possible mitigation measures, and ultimately determine project acceptability. These processes are delivered by the B.C. Environmental Assessment Office (BCEAO) and the Canadian Environmental Assessment Agency (CEAA).

BC Hydro is also regulated by the BCUC, under the *Utilities Commission Act*.

Further information is available on the following websites:

- B.C. Environmental Assessment Office
www.eao.gov.bc.ca
- Canadian Environmental Assessment Agency
www.ceaa.gc.ca
- British Columbia Utilities Commission
www.bcuc.com



Old Fort, Fort St. John, downstream from Site C

7.1.1 CURRENT CONDITIONS

For any large project in the early planning stages, the first step in regards to environmental and socio-economic considerations is to gather baseline information to better understand current conditions. For the potential Site C project, baseline studies, through primary research and collection of existing information, allow BC Hydro to characterize the current use of the river, valley and region by animals and people.

7.2 PURPOSE

The purpose of the Stage 2 environmental work was to:

- Identify the potential environmental, social, economic, heritage and health factors associated with the Site C project.
- Characterize the current physical, biological and socio-economic environment surrounding the potential Site C project.
- Support and participate in public, stakeholder and Aboriginal consultation processes.



Northwest shoreline of the Peace River.

7.3 SCOPE

To achieve the environmental objectives for Stage 2, BC Hydro developed programs to better understand the current conditions for:

ENVIRONMENTAL TOPICS	SOCIO-ECONOMIC TOPICS
<ul style="list-style-type: none"> • Local climate and greenhouse gas • Fish and aquatic habitat • Heritage • Vegetation and wildlife • Water quality 	<ul style="list-style-type: none"> • Community services and infrastructure • Economic • Land use and resources

During Stage 2, baseline studies were completed to describe existing conditions and identify data gaps. While the scope of work was largely on current conditions, this chapter also presents the preliminary results of predictive modelling of Site C project greenhouse gas (GHG) emissions, since a standardized model and input data were available at this stage.

In general, the study boundaries for environmental baseline studies focused on the Peace River between the Peace Canyon Dam and the B.C.-Alberta border, local tributaries, the transmission corridor between the Peace Canyon Dam and the potential Site C dam site, and adjacent areas. For socio-economic baseline work, the local study area generally included the local communities, and the regional study area included the Peace region. Actual study boundaries are described in reports for each study.

The objective of identifying potential environmental and socio-economic issues included identifying potential regulatory and permitting requirements, assessment methodologies, and data needs. To support this work, BC Hydro established Technical Advisory Committees (TACs) to engage First Nations and local, provincial and federal government agencies and regulators. Committees were established for key program areas, including fish, wildlife, heritage, greenhouse gas, recreation and tourism, land and resource use, and community services and infrastructure topics. These TACs offered participants an opportunity to understand the potential project and evaluation processes, review historic and recent studies, explore potential issues and effects, and provide BC Hydro with early input on potential data gaps and assessment methodologies that could support an environmental impact assessment, should the project proceed to an environmental and regulatory review.



Lynx Creek tributary at the Peace River.

7.4 KEY FINDINGS – BASELINE RESULTS

7.4.1 FISH AND AQUATIC ENVIRONMENT

BC Hydro has completed a number of baseline studies on fish populations and fish habitat. Baseline data characterize current fish populations and the use of the river by fish. If the project proceeds to the regulatory stage, a future environmental assessment would describe the possible effects of the project on fish and fish habitat, including any mitigation measures proposed to reduce impacts.

The Stage 1 report indicated that further fish studies would concentrate on tracking movements and migration and seasonal use of mainstem and tributaries. This commitment was fulfilled in Stage 2 with multi-year and multi-season fish and fish habitat baseline condition surveys and analysis that built upon previous Peace River studies.

During public and stakeholder consultations, the public indicated some concern about how fish would be affected by the potential dam and reservoir. Based on responses to feedback forms during consultation, the public indicated their sport fish preferences, and their interest in both shore- and boat-based angling opportunities. The technical study program included an analysis of sport fish species, and the 2008 initiation of a recreation and angler survey has provided more user information related to the public fishery and fishing opportunities on the Peace and Pine rivers.

7.4.1.1 FISH MOVEMENT (RADIO TRACKING)

The Stage 2 fish movement and tracking study was conducted to develop a further understanding of key fish species movements and seasonal variation of these movements in the Peace River, in its tributaries and around the proposed project area. The Stage 2 tracking information will supplement previous tracking data on the Peace River and provide new information on Pine River fish species movements.

Radio-tagged fish were tracked from early spring through fall in 2007 and 2008 in the Peace River mainstem — from Peace Canyon Dam to the town of Peace River, Alberta — and in the Halfway River and Pine River tributaries.

As a result of the tracking study, BC Hydro has learned that walleye have the largest average movement range (in the lower Peace River), Arctic grayling and bull trout have moderate average movement ranges, and rainbow trout and mountain whitefish have very short average movement ranges. Further results of the fish telemetry program are summarized in Table 7-1.

In addition, preliminary information suggests that Arctic grayling and bull trout may be the primary species of interest for consideration of potential passage feasibility past the dam site. Further work on fish passage, including biological and technical feasibility considerations, would be part of an environmental and regulatory review, should the project proceed.



Peace River upstream from the potential Site C dam site location.

TABLE 7-1: FISH MOVEMENT STUDIES – KEY BASELINE FINDINGS

FISH SPECIES	AVERAGE MOVEMENT RANGE	RESULTS
Arctic grayling	45 km	<ul style="list-style-type: none"> • Peace River Arctic grayling are the most likely fish species to pass through the proposed project area. • Spawning occurs in the Moberly and Halfway rivers in the spring, after which Arctic grayling return to the Peace River mainstem to feed and overwinter. • To date, Pine River Arctic grayling appear to be resident and are not likely to exit the Pine River watershed or pass through the proposed project site.
Rainbow trout	9 km	<ul style="list-style-type: none"> • Individual rainbow trout have been recorded primarily in the mainstem from the Peace Canyon Dam downstream to the Halfway River. • Spawning migrations occur in the spring primarily in the smaller tributaries (Maurice, Lynx and Farrell creeks), after which the fish return to the Peace mainstem to forage and overwinter. • Rainbow trout have a low probability of moving through the proposed Site C project area.
Mountain whitefish	6 km	<ul style="list-style-type: none"> • Mountain whitefish are widely distributed in the Peace River mainstem downstream into Alberta; individual range of movements are minor. • Spawning occurs in the autumn and appears to occur in the Peace mainstem, and in the Moberly and Halfway rivers.
Bull trout	51 km (2007) 27 km (2008)	<ul style="list-style-type: none"> • Individual bull trout showed considerable variation in ranges of movements between years. • Pine River bull trout are mainly resident fish, with relatively few bull trout moving into the Peace River. • Movements recorded through the proposed Site C location were low: four fish in 2007 and three fish in 2008.
Walleye	86 km	<ul style="list-style-type: none"> • Walleye move extensively downstream of the Site C location, within and between the Peace River mainstem and major tributary mouths into Alberta. • Spring migrations show spawning in the Beatton River, with extensive post-spawning feeding movements from the Beatton upstream to the Pine River and later back to the Beatton River mouth to overwinter.

7.4.1.2 PEACE RIVER TRIBUTARY FISHERIES STUDIES

The Stage 2 tributary fisheries baseline studies were a continuation of previous studies to determine species composition, distribution and relative abundance in areas upstream and downstream of the proposed Site C reservoir inundation area in the tributaries. In addition, studies set out to characterize juvenile fish rearing habitats, seasonal fish usage and life history requisites, and to collect water temperature and discharge measurements in the tributaries. These baseline results would assist BC Hydro in assessing the potential impacts of reservoir flooding, should the project proceed.

The Stage 2 Peace River tributary fisheries study area included Moberly River, Wilder Creek, Cache Creek, Red Creek, Halfway River, Farrell Creek, Lynx Creek and Maurice Creek.

The study consisted of four components: summer juvenile fish use in tributaries, spring and fall tributary spawner migration, bull trout spawner assessment in the upper Halfway River, and fish tissue sampling for mercury. The results are shown in Table 7-2.

Should the Site C project advance to Stage 3, future studies would assist in the assessment of fish communities and the evaluation of potential fish passage options. Potential areas of focus may include spawning migrations, spawning areas in lower tributary reaches, fish movements to critical habitat, and measuring juvenile fish out-migration. Further fisheries work would also focus on assessment of reservoir and downstream productivity, entrainment and mortality, and habitat assessment for project design and routing (e.g., roads, bridges and transmission line).

TABLE 7-2: PEACE RIVER TRIBUTARY FISHERIES STUDY – KEY BASELINE FINDINGS

STUDY COMPONENT	RESULTS
Juvenile fish tributary use study	<ul style="list-style-type: none"> • Environmental conditions such as water temperature, discharge and sediment load had strong influences on availability and quality of juvenile fish habitats, and in limiting juvenile fish use in tributaries.
Spring and fall tributary spawner migration	<ul style="list-style-type: none"> • In spring 2008, a total of 5,878 fish representing 20 fish species were recorded in the study tributaries; 11 of these species were adult fish in spawning condition, indicating numerous fish species use tributaries for spring spawning. • During the fall program, 1,961 fish were sampled in the Moberly and Halfway rivers, with mountain whitefish and redbreast shiners dominating. • The fall program established that mountain whitefish originating in the Peace River spawn in the Halfway and Moberly rivers, and confirmed they did not spawn in the smaller tributaries.
Bull trout spawner assessment	<ul style="list-style-type: none"> • The total number of bull trout counted and the total number of redds enumerated in the upper Halfway River tributaries were higher than previously observed. The population increased between 2002 and 2005, and this trend appears to have continued in 2008.
Peace River fish tissue sampling for mercury	<ul style="list-style-type: none"> • Preliminary evidence shows a decline in total mercury concentration in muscle tissue of bull trout and mountain whitefish in the Peace River from 1989 to 2008, and shows levels are below Health Canada advisory levels for mercury in commercial fish.

7.4.1.3 METHYL MERCURY

As discussed in the Stage 1 report, inorganic mercury from flooded soils and decaying vegetation may be converted by bacteria into methyl mercury, a form that can be taken up by the aquatic food chain. Available evidence suggests that methyl mercury levels may increase for a time after reservoir flooding, followed by a decline over time to baseline levels. The amount and duration of methyl mercury levels would be influenced by the amount of flooded vegetation and the background levels of inorganic mercury present. Vegetation samples collected to date in the area of the potential Site C reservoir detected very low background levels of inorganic mercury. In addition, BC Hydro has committed to a reservoir clearing program that would remove trees prior to flooding. Should the project proceed, an assessment would be done to predict methyl mercury levels over time.

Health Canada indicates that methyl mercury tends to accumulate to some degree in all fish, and especially in predatory species that eat lots of other fish, and applies a standard of 0.5 parts per million (ppm) total mercury to commercially sold fish. During Stage 2, baseline levels of mercury in fish in the Peace River were measured. Fish tissue samples were collected in 2008 from bull trout and mountain whitefish and analyzed for mercury accumulation. Preliminary evidence shows that total mercury concentration in muscle tissue of bull trout and mountain whitefish in the Peace River has declined from 1989 to 2008, and is below Health Canada advisory levels.¹⁸ Further work on methyl mercury would be conducted should the project proceed to Stage 3.

7.4.2 WATER QUALITY

The Water Quality Baseline Study collected a multi-year suite of water quality data (nutrients, water quality, metals, chlorophyll a, etc.) for current and potential future use, related to Site C. For example, water temperature data may be used in reservoir and downstream water temperature modelling, and climate modelling, and would provide a pre-project baseline for future monitoring programs.

A complete water temperature data set was collected from the Peace River and selected tributaries from the Peace Canyon Dam downstream to the Alberta border. As expected, water temperatures in the Peace River were cooler in the summer months but warmer in the winter months than in the tributaries. Monthly water temperatures nearest the Peace Canyon Dam were cooler in the summer months than those recorded at downstream Peace River sites. Both of these findings reflect influences of the Dinosaur Reservoir and tributary inflows on mainstem temperatures.

Monthly tributary water temperatures were substantially warmer than those in the Peace River through late spring, summer and early fall, with highest temperatures corresponding to decreasing spring runoff. Some of the warmest tributary temperatures were observed in the Beatton and Kiskatinaw rivers, with daily maximums exceeding 28° C. Actual water temperature data is important for predicting future water temperatures in and downstream from the potential Site C reservoir.

Turbidity (suspended sediment) data suggests two distinct Peace River turbidity peaks associated with tributary peak runoffs. The first major peak in turbidity occurs in April and appears to be associated with smaller tributaries and initial spring melt from low-lying areas. The second major peak, recorded in June, is associated with runoff in the larger Halfway and Moberly rivers. Turbidity can have limiting effects on fish species distribution and is also correlated to total suspended solids and downstream sediment transport modelling.

Sediment, soil and vegetation samples were also collected and analyzed (for metals, for example) to identify potential areas that might need further investigation and to provide a pre-project baseline for future monitoring programs. Total and dissolved levels of mercury were below detection levels for all water quality samples, while vegetation samples detected very low levels of total mercury. This data would contribute to methyl mercury modelling, should the project proceed.

¹⁸ Health Canada. *Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption*. (2007) http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/merc_fish_poisson-eng.pdf.

7.4.3 HERITAGE AND CULTURAL RESOURCES

The Stage 1 report identified four kinds of heritage resources that could be affected by the Site C project, including:

- Historic sites, such as fur trading forts
- Prehistoric (archaeology) sites
- Paleontologic or fossil-bearing sites
- Ethnographic or traditional social and religious sites

During public consultation, participants identified the importance of heritage in the Peace River valley, and responded to questions about the importance of heritage sites in evaluating project components such as options for Highway 29 realignment, and the importance of potential mitigation and management options for heritage resources.

During Stage 2, work focused on reviewing previous heritage field work and studies, and considered input from the public and key government agencies. BC Hydro commissioned a data gap analysis of heritage resources (archaeological, historical and paleontological), including an examination of past and current information, and the identification of information required for an environmental and regulatory review.¹⁹

A Heritage Resources Technical Advisory Committee (TAC) was established with representation from Blueberry River First Nation, the B.C. Archaeology Branch and the District of Taylor. Separate meetings were held with museum and other First Nation representatives, and a commitment was made to work with local First Nations to discuss how to bring traditional knowledge and use into consideration. The Heritage TAC identified potential project effects on heritage resources, particularly from ground-disturbing activities that may expose, move, remove or prevent access to heritage sites.

The key finding in Stage 2, based on the data gap analysis and input from the Heritage TAC, was confirmation that federal and provincial regulatory requirements, and specifically the *Heritage Conservation Act*, direct the need for an Archaeological Impact Assessment if the project proceeds to the next stage.²⁰ Although extensive heritage assessments were previously completed, new surveys and revisits to previously recorded sites would likely be needed. The provincial government is also leading development of a fossil management framework for British Columbia.²¹

In addition, an archaeological-potential model was initiated in 2009. If the project proceeds to Stage 3, this model would guide heritage field studies planning, including input from First Nations and the B.C. Archaeology Branch.

7.4.4 LOCAL CLIMATE

During historic assessments of Site C and Stage 2 consultation, BC Hydro heard public concerns about the potential for the reservoir to change local climatic conditions, and any related effects on transportation safety and agriculture.

During Stage 2, climate work focused on the development of a long-term climate monitoring program for the Peace River valley, beginning with the implementation of wind monitoring stations in early 2009. When installed, this network will collect valley bottom data to establish a pre-project baseline of local climate variables, such as precipitation, wind and air temperature.

During Stage 2, BC Hydro commissioned the development of a regional climate model (weather model) and a water temperature model, both of which can measure predicted changes to local climate or water variables as a result of the Site C project. The scientists developing these models will identify any new data requirements necessary to refine or calibrate the models, including any instrumentation needed for the local climate monitoring network.

¹⁹ Arcas. *Peace River Site C – Heritage Resources Data Gap Analysis – Final Report, 2008.*

²⁰ B.C. Archaeology Branch, Ministry of Small Business, Tourism and Culture. *British Columbia Archaeological Impact Assessment Guidelines.* (1998)

²¹ Fossil Management Review Technical Working Group. *Fossil Management for British Columbia.* (2004) http://www.agf.gov.bc.ca/clad/strategic_land/fossil.html.

7.4.5 VEGETATION

Site C terrestrial studies in the 1970s and 1980s focused on consumptive wildlife resources (i.e., species that were hunted or trapped). Since then, plant communities (ecosystems) and individual plants have also been identified as areas of conservation interest.

Current baseline data collection on ecosystems and individual plant species within the potential Site C project area began in 2005. Additional baseline work in Stage 2 included vegetation surveys and ecosystem mapping to document the existing presence and distribution of ecosystems and plant species at risk within the potential project area.

Terrestrial ecosystem mapping (TEM)²² completed for the local study area of 63,965 hectares used a combination of ecological features to classify the landscape into habitat units. The TEM identified 22 ecological communities and 17 non-vegetated habitats altered by human activities, and provided a useful base for further terrestrial study work.

The vegetation surveys and mapping during Stage 1 and 2 found:

- 28 red- or blue-listed plant species in the study area over a three-year period.²³
- Three ecosystems and 72 plant species at risk (provincial) that potentially occur in the Peace River corridor.
- A total of 43 ecosystems within the project area.

As with wildlife, the provincial and federal plant species at risk lists are updated regularly, resulting in species being added or removed from the list, or changed in their ranking. Also, during the Technical Advisory Committee discussions, a local First Nation representative noted that traditional knowledge may identify other plants of interest, including rare plants or medicinal plants for traditional use. BC Hydro committed to work further with this First Nations community to bring forward traditional knowledge relevant to the assessment of Site C.

Should the project advance to Stage 3, the need and scope for new studies on select plant species and groups would be identified. An environmental assessment would entail a description of possible effects on key plant communities, including proposed mitigation measures to reduce impacts. Follow-up monitoring would also be required.

²² Ecosystem mapping is the stratification of a landscape into map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil and vegetation.

²³ Keystone Wildlife Research. *Peace River Site C Hydro Project – 2008 Baseline Vegetation and Wildlife Report* (2009).



Vegetation along the Peace River.

7.4.6 WILDLIFE

During Stage 2, BC Hydro commissioned extensive surveys to develop a multi-year baseline database of wildlife presence and habitat use in the vicinity of the potential project; however, at this stage the potential effects on wildlife have not been determined.

For Stage 2, the wildlife study area extended from Hudson's Hope to the Alberta border, encompassing the Peace River corridor (63,965 hectares) and the transmission line corridor. The river corridor included the entire river valley, including the floodplain and the ascending slopes, extending approximately 2 kilometres on either side of the Peace River. The transmission line corridor extended 500 metres on either side of the existing transmission line between Hudson's Hope and the location of the potential Site C project.

Field surveys were informed by key tools including the Terrestrial Ecosystem Mapping and habitat suitability analysis. Wildlife surveys were focused on historically important harvestable species, as well as on species of interest in current federal and provincial conservation frameworks.²⁴

²⁴ Species may have a designated status through the federal Species at Risk Act or through the provincial Conservation Data Centre. For example, provincially red-listed species or communities are extirpated, endangered or threatened in British Columbia, and blue-listed species or communities are considered to be of special concern in British Columbia.



Deer in the forest in the Peace River region.

First Nations and local, provincial and federal government agencies were invited to review the program at the Wildlife Technical Advisory Committee, and they provided input and advice regarding methods, timing, sampling and completeness of the baseline inventory data, including the need for regional scale information for key species, habitats and distribution. Throughout Stage 2, BC Hydro has worked with the regional office of the Ministry of Environment to identify the existence of or need for species-specific data on a regional scale.

During Stage 2, the public, government agencies and First Nations raised a number of wildlife-specific issues, including the potential effects on ungulates (deer, elk, moose and Stone sheep) and garter snake habitats within the potential reservoir area. In response to this feedback, some changes were made to the Stage 2 wildlife program. Other issues or data gaps would be addressed in the next stage, should the project advance.

Key baseline survey results, by species group, are summarized in Table 7-3.

At this stage, the recorded presence of listed species leads to special consideration in determining future field surveys and expansion of surveys to a regional scale. Should the project proceed to Stage 3, these species would be addressed in the environmental assessment.

TABLE 7-3: VEGETATION AND WILDLIFE SURVEYS – KEY BASELINE FINDINGS

Baseline data characterize the current use of the river and valley by wildlife. If the project proceeds to Stage 3, a future environmental assessment would analyze and describe the possible effects

of the project on wildlife, including any proposed mitigation measures to reduce impacts, and follow-up monitoring.

INDICATOR	RESULTS
Rare plants	<ul style="list-style-type: none"> • Preliminary analysis indicates 588 different plant taxa detected in 2008, of which 59 are non-native.
Amphibians	<ul style="list-style-type: none"> • In 2008, western toad, boreal chorus frog and wood frog were detected. Wood frogs were detected the most frequently. • Adult, subadult and tadpole western toads were detected in the Peace River corridor and along the related transmission line.
Reptiles	<ul style="list-style-type: none"> • Surveys from 2005 found the presence of common garter snakes (seven sites) and western terrestrial garter snakes (five sites) in the potential project area.
Butterflies and dragonflies	<ul style="list-style-type: none"> • In 2008, 56 butterfly species were observed with 46 species in the Peace River corridor and 32 along the related transmission line, including Assiniboine skipper, great spangled fritillary, common ringlet and tawny crescent. • In 2008, 155 specimens of 18 different dragonfly species were collected.
Bats	<ul style="list-style-type: none"> • In 2008, six different bat species were sampled in the study area (big brown bat, silver-haired bat, long-eared myotis, little brown bat, northern myotis and long-legged bat).
Fur-bearers	<ul style="list-style-type: none"> • In 2006, surveys between Hudson’s Hope and the Alberta border found 67 active colonies of beaver, with an estimated population of 335. • Fisher hair snag surveys were conducted to provide data on the distribution, number and sex of fisher using habitats in the Peace River Valley. DNA analysis will be completed by winter 2009/2010.
Ungulates	<ul style="list-style-type: none"> • The 2009 ungulate winter counts, conducted in February 2009, documented approximately 343 moose, 608 elk and 1,759 deer within the study area. Of these, 108 moose, 98 elk and 203 deer were within the potential reservoir area. • Ongoing surveys on Stone sheep will collect data on presence and habitat use in and adjacent to the potential reservoir area.
Owls	<ul style="list-style-type: none"> • Six species of owls were documented during 2006 (Northern Saw-whet Owl, Great Horned Owl, Barred Owl, Short-eared Owl, Boreal Owl and Great Grey Owl). • In 2008, 78 owl detections occurred during call-playback surveys. Barred Owls were detected 39 times, Northern saw-whet Owls 16 times, Great Horned Owls 11 times, Great Grey Owls nine times and Boreal Owls once.
Raptors	<ul style="list-style-type: none"> • In 2008, 40 nest sites were documented on islands and in the forest along the Peace River. Activity was confirmed at 26 nests. • Of the 26 active nests observed in 2008, 25 were of bald eagle. Eleven of these were in the potential reservoir. • One American kestrel was observed nesting in an aspen and four immature bald eagles were observed near active nests.
Songbirds	<ul style="list-style-type: none"> • In 2008, 90 songbird species were detected in the study area.
Waterfowl	<ul style="list-style-type: none"> • 2008 surveys detected 57 species of waterfowl and water-associated birds. Upland Sandpiper, California Gull, Great Blue Heron, Sandhill Crane and Surf Scoter were detected in the Peace River corridor. All but the Upland Sandpiper are migrants and do not breed in the area.

7.4.7 COMMUNITY SERVICES AND INFRASTRUCTURE

Community services and infrastructure requirements tend to be a direct function of population. Population forecasts for the region indicate a natural population growth. If built, Site C would be expected to result in an incremental increase in the local population due to an in-migration of workers during the planning and construction of the dam.

During Stage 2 consultation, local government representatives raised concerns about how the project may affect the community through increased pressure on local services and infrastructure, housing availability and cost, and the ability for communities to plan in relation to the timing of project decisions.

During Stage 2, BC Hydro collected and reviewed information from existing published sources on the current capacity and status of community services and infrastructure in the region including, as appropriate, inventories of existing facilities, service and use levels, and future plans. In addition to identifying potential issues, BC Hydro also identified areas where new primary studies may be required to improve the baseline data and BC Hydro's understanding of current conditions. Key issues related to the size and characteristics of the local and regional population may include matters related to housing, transportation and the need to expand or advance community infrastructure and services, including health services.



Road improvement project near Fort St. John (September 2009).

Transportation issues for the potential Site C project relate to Highway 29 realignment options, consideration of public use of the powerhouse access bridge, and general construction activities.

If Site C proceeds to Stage 3, a socio-economic effects assessment would be included in an environmental and regulatory review.

7.4.8 ECONOMIC

During Stage 2, BC Hydro identified economic issues and collected preliminary baseline information related to the potential Site C project, such as current conditions regarding the regional labour market, government and economic development.

If the project were to proceed to construction in the future, there would be a significant increase in the number of jobs and business opportunities in the region over the seven-year construction period. Based on the historic design of the project, it is estimated that Site C would create 7,650 person-years of direct construction employment during the seven-year construction period. In total, Site C is estimated to create 35,000 direct and indirect jobs through all stages of the project.

During consultation, representatives of local government shared their experiences and concerns in relation to project and economic cycles and how they can affect regional development. An assessment of labour force impacts would be required if the project advances to Stage 3.

7.4.9 LAND USE AND RESOURCES

During technical advisory meetings, regional, provincial and federal government agencies and First Nations provided BC Hydro with input into potential land and resource management considerations in relation to the potential project. BC Hydro also initiated the collection of relevant preliminary baseline information.

Key findings for the land use and resource values are summarized in Table 7-4. Land use and resources management and data would need to be reviewed and potentially updated for completion of a socio-economic effects assessment, as part of an environmental assessment application, if the project proceeds to an environmental and regulatory review.

TABLE 7-4: LAND USE AND RESOURCES – KEY BASELINE FINDINGS

INDICATOR	DISCUSSION
Land use	<ul style="list-style-type: none"> Industrial land and resource use on the south bank is currently constrained by provincial land management objectives based on the outcomes of the Land and Resources Management Plans (LRMPs). North bank land and resource use is currently dominated by private land use and Crown leases in agriculture. The recommendation in the region’s LRMPs for the creation of the Peace River/ Boudreau Lake Protected Area has already influenced and constrained new land use. However, the protected-area recommendations were framed to not preclude existing oil and gas tenures, or the potential Site C project, in acknowledgement of the order-in-council flood reserve.
Water use	<ul style="list-style-type: none"> Regional water uses identified by various stakeholders include local water supply (springs and wells), agricultural use, pre-existing water licences associated with the Peace River, and existing hydro operations associated with BC Hydro’s two upstream generating stations.
Agriculture and range	<ul style="list-style-type: none"> Conflicting data sources regarding existing agricultural land indicated that an updated agricultural land capability and use study would be required to complete an agricultural impact assessment.
Forestry	<ul style="list-style-type: none"> The estimated forested land base in the potential project area contributes approximately 2,400 cubic metres per year (less than one per cent) to a total annual allowable cut (AAC) of almost four million cubic metres (Dawson Creek and Fort St. John timber supply areas combined). The region’s mills have the capacity to process the deciduous and coniferous timber that would be cleared from the potential project areas.
Oil and gas	<ul style="list-style-type: none"> Oil and gas activity is relatively minor in the Site C project area, and licensees in recent tenures were notified of the Site C flood reserve.
Mineral development	<ul style="list-style-type: none"> The potential Site C project area and adjacent provincial land management render much of the area subject to a no-staking reserve for minerals, placer and coal. Active and inactive aggregate reserves exist within the potential project area.

7.4.10 RECREATION, TOURISM AND RELATED TOPICS

The Peace River is used by residents and tourists for many outdoor recreation activities. If the Site C project were to proceed, recreation impacts would be assessed with a focus on the transition toward reservoir-based activities — such as boating, fishing, hiking and camping — from the current river-based recreation upstream of the potential dam.

A 2008 recreation survey confirms that outdoor recreation activity in the Peace River region is relatively high, focusing around 34 documented formal and informal recreation sites between the Peace Canyon Dam and the B.C.-Alberta border. The most common recreation activities indicated are fishing, boating, camping and shoreline leisure (from May to September), with a shift to hunting in October, and low recreational use in winter.

Associated tourism features of the region include amenities and services, transportation infrastructure (highways and airports) and the scenic corridors throughout the area.

RESERVOIRS AND CLIMATE CHANGE

When reservoirs are developed, vegetation and trees are cleared and the area is flooded. Scientists have identified that Canadian boreal reservoirs incur an initial spike in greenhouse gas (GHG) emissions in the first few years as the carbon stored in the cleared and flooded vegetation is released, followed by a sharp decline to levels similar to nearby water bodies. For example, GHG emission rates from some of BC Hydro's established reservoirs have been measured, and show similar emission rates to lakes and rivers in the same areas.

Research has also shown that the GHG emission intensity from Canada's northern boreal hydroelectric projects is much lower than tropical reservoirs. This is because the key climatic conditions (e.g., temperature) that contribute to reservoir emissions vary around the world. Preliminary research suggests that Site C, in a colder northern climate, would be in the low end of emission ranges for reservoirs worldwide.

Hydroelectric reservoirs in Canada are considered to be one of the cleanest ways to generate electricity because they have low GHG emissions compared to other forms of electricity generation. For example, Canadian hydroelectric projects emit no more than 10 per cent of the emissions per unit of energy produced from other common dependable electricity options, such as natural gas, diesel or coal.²⁵ As a result, hydroelectric projects can play a role in combating climate change.



Dinosaur Reservoir, upstream of Peace Canyon Dam (September 2009).

²⁵ All comparison emission factors from International Rivers Network. *Fizzy Science: Loosening the Hydro Industry's Grip on Reservoir Greenhouse Gas Emissions Research*. (2006) www.irn.org.



Boating on the Halfway River tributary.

7.5 KEY FINDINGS – PRELIMINARY GREENHOUSE GAS EMISSION STUDY

During Stage 1, BC Hydro identified the need for an estimate of greenhouse gas (GHG) emissions associated with the potential Site C project. As a result, during Stage 2, a preliminary GHG emissions estimate was developed. The estimate is made up of reservoir and land use change emissions based on the Intergovernmental Panel on Climate Change (IPCC) model guidelines, as well as construction phase emissions based on preliminary estimates for quantities of fuel, electricity and materials.

Preliminary results from GHG modelling in Stage 2 found that the Site C project would produce among the lowest emissions, per gigawatt hour (GWh), when compared to other forms of electricity generation.²⁶ Over the next 100 years, Site C would produce the same or lower GHG emissions than all other options available in B.C. for 4,600 GWh of dependable energy per year.

As would be expected, the Site C project would produce significantly less GHGs per gigawatt hour than fossil fuel sources such as natural gas, diesel or coal. Preliminary estimates also suggest that the GHG emissions per gigawatt hour from Site C would fall within the ranges expected for other renewable sources, such as wind and geothermal, while outperforming solar photovoltaics.

²⁶ Greenhouse gas (GHG) emission estimates were modelled using the Intergovernmental Panel on Climate Change (IPCC) Tier 1, 2 and 3 guidelines. A conservative/default and a probable Tier 3 scenario were modelled based on treatment of three key parameters (biomass burial, sedimentation rate, and merchantable timber fraction). This chapter reports the conservative (default) Tier 3 estimate, which in general uses the most land- and project-specific information to develop a detailed carbon model to account for all substantive carbon stocks, processes and fluxes. Refer to the *Peace River Site C Hydro Project Stage 2 – Greenhouse Gas Emissions Report* for full modelling details and results. The conservative value is reported here.



Hills above Bear Flat.

TABLE 7-5: PRELIMINARY GHG EMISSION CALCULATIONS – RESERVOIR AND OPERATIONS

INDICATOR	RESULTS
Reservoir and operating emissions	<ul style="list-style-type: none"> • According to the most conservative estimate, Site C would emit a net total of approximately four million tonnes of CO₂e²⁷ over its lifespan, or approximately 41,000 tonnes of CO₂e per year over the first 100 years of operation. This amounts to an emission intensity of approximately 9 tonnes of GHG per GWh of energy. • About 85 per cent of total net reservoir emissions would occur in the first 10 years, driven by the release of carbon arising from the change from a vegetated to a flooded landscape. Net emissions would be much lower from years 11 to 35, and would be similar to the existing, or pre-reservoir landscape, from years 36 to 100 of operations.
Construction phase emissions	<ul style="list-style-type: none"> • Fuel, electricity, and construction materials could emit a total of approximately 743,000 to 1,100,000 tonnes of GHG. This amounts to between 1.6 and 2.4 tonnes of GHG per GWh of energy produced by Site C over its lifespan. • All construction phase emissions would occur prior to operations.
Comparing Site C with other generation technologies	<ul style="list-style-type: none"> • Considering construction, reservoir development and operating phase emissions, the Site C project would emit between 10.6 and 11.4 tonnes of GHG per GWh of energy. • Site C would fall within the low end of the emission range reported for reservoirs around the world, based on the International River Network’s comparison of emissions intensities associated with different electricity generation technologies.²⁸ • Site C would emit far less GHG emissions than fossil fuel generation for the same amount of energy. • Compared with other renewable technologies, the preliminary emissions estimate for Site C falls within the ranges reported for wind and geothermal, and outperforms solar photovoltaics.

Many scientific studies have compared the emissions intensities associated with different electricity generation technologies. The International Rivers Network (IRN) reviewed a number of these studies in 2006, and average values for different dependable generation technologies are included in Figure 7-1. The Pembina Institute²⁹ estimated that Manitoba Hydro’s Wuskwatim hydroelectric project, now under construction, would emit approximately 4 tonnes of GHG per GWh of energy, or a total of 1.8 million tonnes over its life. Similar to the

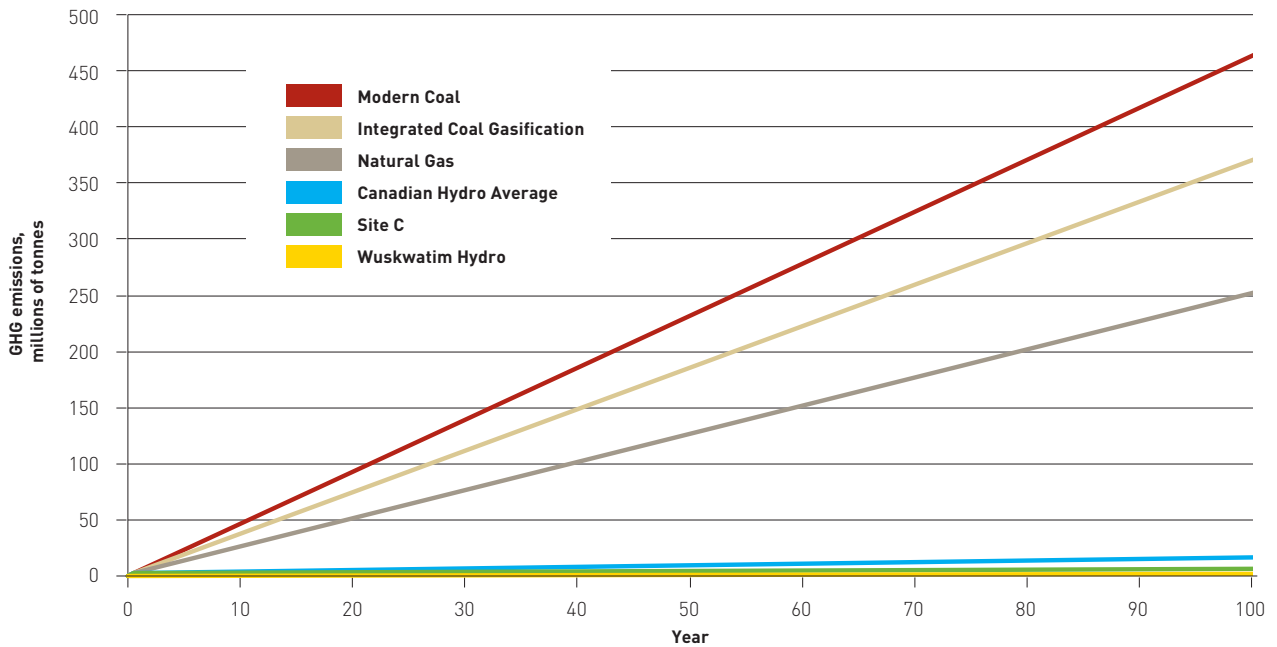
Site C GHG study, the Wuskwatim estimate included emissions from construction, materials and the reservoir. The preliminary GHG emissions estimate for Site C falls in the low end of the emission range reported for boreal reservoirs (represented as the Canadian hydro average in Figure 7-1), which in turn were identified in the IRN report as the world’s lowest emission category of reservoir.

²⁷ CO₂e refers to Carbon Dioxide Equivalent. The B.C. Ministry of Environment defines CO₂e as the unit of measurement that defines the global warming potential (GWP) of the six greenhouse gases. CO₂e is expressed in terms of the global warming potential of one unit of carbon dioxide. Expressing all greenhouse gases in terms of tonnes of CO₂e allows the different gases to be grouped together.

²⁸ International Rivers Network. *Fizzy Science: Loosening the Hydro Industry’s Grip on Reservoir Greenhouse Gas Emissions Research*. (2006) www.irn.org.

²⁹ Pembina Institute for Appropriate Development. *Life Cycle Emissions and Land Change Related to Selected Power Generation Options in Manitoba*. (2003)

FIGURE 7-1: TOTAL GHG EMISSIONS RELEASED OVER TIME, VARIOUS DEPENDABLE GENERATION TECHNOLOGIES (4,600 GWH PER YEAR)



Emission rates for Canadian hydroelectric and the fossil fuel technologies are the average of a sample of emissions rates from these technologies (IRN 2006), and the Manitoba Wuskwatim Hydro project lifecycle emissions (Pembina 2003). While coal technologies are not part of the B.C. resource options assessment, coal-fired plants operate in the western North American grid. The Canadian hydro average rate is based on reservoir emissions only.

Table 7-6 compares the preliminary estimate of Site C emissions with other renewable generation technologies. Values from published peer-reviewed studies suggest a range of 7 to 22 tonnes of GHG/GWh for wind, giving an average of 14 tonnes/GWh.³⁰ One published estimate suggests

an emissions intensity of 15 tonnes of GHG/GWh from geothermal energy,³¹ and an average range of emissions from solar photovoltaics is approximately 48 tonnes GHG/GWh.³² Emissions from renewable technologies arise largely from the construction activities and materials.

TABLE 7-6: EMISSIONS INTENSITY (TONNES OF GHG/GWH) RANGES AND AVERAGE VALUES FOR RENEWABLE GENERATION TECHNOLOGIES³³

TECHNOLOGY TYPE	DATA SOURCE	EMISSIONS INTENSITY AVERAGE (AND RANGE)
Site C Hydro reservoir and construction	BC Hydro construction emissions estimate and IPCC Tier 3 model	11
Wuskwatim Hydro (Manitoba)	Pembina Institute, 2003	4
Wind	World Energy Council, 2004	14 (7-22)
Geothermal	Hondo, H. 2005	15
Solar photovoltaics	World Energy Council, 2004	48 (43-55)

The GHG emissions estimate for Site C is based on the conservative Tier 3 reservoir scenario plus the high estimate for construction activities and materials. As single projects, Wuskwatim Hydro and geothermal do not have ranges. Ranges for wind and solar are based on several projects in each category as reported in the IRN report.

³⁰ International Rivers Network. *Fuzzy Science: Loosening the Hydro Industry's Grip on Reservoir Greenhouse Gas Emissions Research*. (2006) www.irn.org.

³¹ Hondo, H. 2005. "Life cycle GHG emission analysis of power generation systems: Japanese case." *Energy* 30 (2005): 2042–2056.

³² The World Energy Council. *Comparison of Energy Systems Using Life Cycle Assessment: A Special Report of the World Energy Council*. (2004) Page 35 gives GHG emissions intensities for eight photovoltaic cases. The average used in that report was calculated by removing both the high and low outlying values, and averaging the remaining six.

³³ The comparisons made between Site C and the technologies in Table 7-6 are for illustration purposes only. Further study is required if the project advances to an environmental and regulatory review.

7.5.1 SITE C GREENHOUSE GAS EMISSIONS OVER TIME

Based on the preliminary estimate, about 85 per cent of total net reservoir emissions from Site C would occur prior to or within the first 10 years of project operations, driven largely by the release of GHG from cleared and submerged vegetation. Reservoir emissions would be much lower from years 11 to 35, and from years 36 to 100, reservoir emissions would be similar to emissions from the existing (pre-reservoir) landscape.

Emissions today from the existing landscape are estimated to be approximately 4,900 tonnes per year, mainly as a result of agricultural activities in the area. Without the Site C project or any other land use change, these GHG emissions would be expected to continue.

If the Site C project proceeds to Stage 3, these GHG estimates would be updated to reflect any refinements to the project plans.

7.6 NEXT STEPS

During Stage 2, BC Hydro set out to identify potential environmental and socio-economic issues associated with the potential Site C project. Baseline studies were completed to characterize the current physical, biological and socio-economic environment and to identify data gaps.

If the project proceeds to an environmental and regulatory review, a future environmental assessment would analyze and describe the possible effects of the project on the natural and human environment, including mitigation measures.

ADDITIONAL INFORMATION

The following baseline reports were conducted during Stage 2 on environmental and socio-economic issues. These studies are available at www.bchydro.com/sitec.

Climate and Greenhouse Gas Emissions

Peace River Site C Hydro Project Stage 2 - Baseline Greenhouse Gas Emissions Report. Jacques Whitford AXYS (Stantec). 2009.

Preliminary GHG Emissions Estimate from Construction Materials – Site C Hydro Project. BC Hydro Memo. 2009.

Fish and Aquatic Habitat

Peace River Fisheries Investigation – Peace River and Pine River Radio Telemetry Study 2007. AMEC Earth & Environmental and LGL Ltd. 2008.

Peace River Fisheries Investigation – Peace River and Pine River Radio Telemetry Study 2008. AMEC Earth & Environmental and LGL Ltd. 2009.

Site C Fisheries Studies - Baseline Peace River Tributaries Fish Use Assessments in Spring and Fall 2008. Mainstream Aquatics Ltd. 2009.

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Baseline Data Collection - Water Quality, River Sediment, Soil, and Vegetation Samples from the Peace River Watershed – 2007. Golder Associates Ltd. 2009.

8.0 CONCLUSION

CHAPTER HIGHLIGHTS

- Based on the Stage 2 key findings, BC Hydro recommends proceeding to the next stage of project planning and development, including an environmental and regulatory review. Should the provincial government decide to advance Site C to the next stage, key components of this stage would include:
 - Refining and updating the project design to incorporate current seismic, safety and environmental considerations, as well as input from consultations.
 - Updating the interim project cost estimate based on an optimized project design.
 - Advancing environmental and socio-economic studies from baseline work to effects assessment, including options for avoiding or mitigating impacts.
 - Continuing to consult with Aboriginal groups.
 - Continuing project consultation and community relations with the public, communities, property owners and stakeholders.
 - Advancing discussions with the Province of Alberta and the Northwest Territories.
 - An independent environmental and regulatory review.

8.1 STAGE 2 PURPOSE

The overall purpose of Stage 2 work was to engage in consultation — as directed by the *BC Energy Plan* — and further define the project in order to develop a recommendation to the provincial government on whether the Site C project should proceed to the next stage. Stage 2 work on the potential Site C project was reviewed in the context of projected electricity demand in the future and provincial energy policy.

8.2 SUMMARY OF KEY FINDINGS

BC Hydro has completed its Stage 2 work. In making a recommendation to government, BC Hydro considered the following key findings:

- Public and stakeholder consultation was comprehensive and province-wide, and helped to inform BC Hydro on the potential impacts and benefits of the Site C project. During public consultations, participants expressed a strong interest in avoiding or mitigating local impacts from the potential Site C project, such as possible socio-economic effects resulting from an influx of construction workers, and potential effects on local air quality, water and agricultural land.
- During Stage 2, BC Hydro initiated consultation and engagement with 41 Aboriginal groups consisting primarily of Treaty 8 First Nations in B.C., as well as Aboriginal groups in Alberta and the Northwest Territories (NWT). Eight consultation agreements representing 13 Aboriginal groups were negotiated. BC Hydro concludes that, if the project proceeds to Stage 3, it would be honourable to do so, as consultation with Aboriginal groups is ongoing and would continue through the environmental and regulatory review stage.
- As a result of Stage 2 engineering work, BC Hydro has concluded that a refined and updated design is required to meet current seismic, safety and environment guidelines and to incorporate input from consultation.
- Baseline environmental and socio-economic studies provided BC Hydro with an understanding of the current environment for fish and aquatic habitat, vegetation and wildlife, water quality, local climate, heritage, community services and infrastructure, as well as economic, land use and resource issues. These studies were informed by input from the public and regulatory agencies.

BC Hydro also considered the potential benefits of proceeding with the Site C hydro project, including:

- Based on the 2008 LTAP, Site C continues to be an attractive resource option from the perspective of reliability and cost, compared to other resource alternatives.
- If built, Site C would be a clean and renewable source of firm and dependable electricity for over 100 years.
- Site C would produce among the lowest GHG emissions, per gigawatt hour, when compared to other forms of electricity generation.
- As the third project on one river system, Site C would gain significant efficiencies by taking advantage of water already stored in the Williston Reservoir. This means that Site C would generate about 30 per cent of the electricity produced at the W.A.C. Bennett Dam with only five per cent of the reservoir area.
- As a source of dependable and flexible electricity, Site C would support the development of renewable resources in B.C. by providing a reliable backup to those renewable resources that are intermittent, such as wind, run-of-river hydro and solar.

8.3 BC HYDRO RECOMMENDATION

Based on the Stage 2 key findings, BC Hydro recommends proceeding to the next stage of project planning and development, including an environmental and regulatory review.

Should the provincial government decide to advance Site C to the next stage, key components of this stage would include:

1. An independent environmental and regulatory review.
2. Refining and updating the project design to incorporate current seismic, safety and environmental considerations, as well as input from consultations.
3. Updating the interim project cost estimate based on an optimized project design.
4. Advancing environmental and socio-economic studies from baseline work to effects assessment, including options for avoiding or mitigating impacts.
5. Continuing to consult with Aboriginal groups.
6. Continuing project consultation and community relations with the public, communities, property owners and stakeholders.
7. Advancing discussions with the Province of Alberta and the Northwest Territories.

APPENDIX

LIST OF STAGE 2 REPORTS

The following Stage 2 reports are available on the BC Hydro website at www.bchydro.com/sitec.

PUBLIC AND STAKEHOLDER CONSULTATION

Pre-Consultation

1. *Peace River Site C Hydro Project: Pre-Consultation Discussion Guide and Feedback Form, December 2007.* BC Hydro. 2007.
2. Public Notification Materials, Pre-Consultation.
3. *BC Hydro Peace River Site C Hydro Project: Pre-Consultation Summary Report, March 15, 2008.* Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.
4. *Peace River Site C Hydro Project: Consideration of Input from Pre-Consultation, December 4, 2007 to February 15, 2008.* BC Hydro. 2008.

Project Definition Consultation, Round 1

5. *Peace River Site C Hydro Project: Project Definition Consultation Discussion Guide and Feedback Form, Round 1: May/June 2008.* BC Hydro. 2008.
6. Public Notification Materials, Round 1 Consultation.
7. *BC Hydro Peace River Site C Hydro Project: Project Definition Consultation, Round 1 Summary Report, September 26, 2008.* Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.

Project Definition Consultation, Round 2

8. *Peace River Site C Hydro Project: Project Definition Consultation Discussion Guide and Feedback Form, Round 2: October/November 2008.* BC Hydro. 2008.
9. Public Notification Materials, Round 2 Consultation.
10. *BC Hydro Site C Hydro Project: Project Definition Consultation, Round 2 Summary Report, February 9, 2009.* Kirk & Co. Consulting Ltd. and Synovate Ltd. 2008.
11. *Peace River Site C Hydro Project: Stage 2 Consideration of Public Consultation Input.* BC Hydro. 2009.

ABORIGINAL CONSULTATION AND ENGAGEMENT

12. *Treaty 8 First Nations Report on Stage 2 Consultation.* Treaty 8 Tribal Association. 2009.
13. *BC Hydro Response to Treaty 8 Tribal Association's Submission on Stage 2 Consultation.* BC Hydro. 2009.

PROPERTIES AND HIGHWAY 29 CONSULTATION

14. *Peace River Site C Hydro Project - Consultation Summary Report: Property Owner Consultation on Potential Highway 29 Realignment Options, Nov. 2008-Mar. 2009.* BC Hydro. 2009.

ENGINEERING AND OPERATIONS

15. *Peace River Site C Hydro Project - Stage 2 Engineering Services Summary Report.* Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.
16. *Peace River Site C Hydro Project - Highway 29 Relocations.* Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.
17. *Peace River Site C Hydro Project - Powerhouse Access Road & Bridge.* Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.
18. *Peace River Site C Hydro Project - Reservoir Shoreline Impacts: Methodology and Criteria.* Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. 2009.
19. *Peace River Site C Hydro Project - Stage 2 Preliminary Clearing Considerations.* Industrial Forestry Service Ltd. 2009.
20. *Peace River Site C Hydro Project - Stage 2 Review of Potential Downstream Changes from Site C Operations - Preliminary Findings.* BC Hydro. 2009.

ENVIRONMENT AND SOCIO-ECONOMIC

Climate and Greenhouse Gas Emissions

21. *Peace River Site C Hydro Project Stage 2 - Baseline Greenhouse Gas Emissions Report.* Jacques Whitford AXYS (Stantec). 2009.
22. *Preliminary GHG Emissions Estimate from Construction Materials - Site C Hydro Project.* BC Hydro Memo. 2009.

Fish and Aquatic Habitat

23. *Peace River Fisheries Investigation - Peace River and Pine River Radio Telemetry Study 2007.* AMEC Earth & Environmental and LGL Ltd. 2008.
24. *Peace River Fisheries Investigation - Peace River and Pine River Radio Telemetry Study 2008.* AMEC Earth & Environmental and LGL Ltd. 2009.
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35. *Baseline Data Collection - Water Quality, River Sediment, Soil, and Vegetation Samples from the Peace River Watershed - 2007.* Golder Associates Ltd. 2009.

For further information:

PEACE RIVER SITE C HYDRO PROJECT

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