APPENDIX C

Part 1 Land and Resource Use Assessment Interview Methodology

1 INTRODUCTION

This appendix summarizes the interview objectives and methodology, and persons contacted for the Land and Resource Use Assessment. Volume 3 Appendix B First Nations Community Baseline Reports lists the First Nations contacted to support completion of First Nations Community Baseline Profiles.

2 INTERVIEW OBJECTIVES

As part of the primary data collection process for the EIS, the Land and Resource Use Assessment Team for the Project conducted phone and/or in-person interviews with local, regional and federal government agencies, industry, and non-government organizations in order to:

- Verify data obtained through secondary sources
- Obtain insights on land and resource use trends and projections
- Establish benchmarks from which to assess project effects
- Obtain views on potential project effects and mitigation measures

Interviews focused on the following general content:

- Land and Resource Use Valued Components (Minerals and Aggregates, Forestry, Oil, Gas and Energy, Outdoor Recreation and Tourism, Harvest of Fish and Wildlife Resources, Navigation):
    - Stakeholders' land and resource use interests within the project footprint
    - Location of land use activities and use areas in or near the project footprint
    - Commercial value of activities in or near the project footprint
    - Public participation levels for activities (e.g., recreation, tourism, hunting, fishing, guide outfitting, trapping) with and near the project footprint
    - Future land use plans, investments, developments within or near project footprint
    - Stakeholders' perspectives on future (base case) conditions in the LAA for land use, potential effects of the proposed Project on land and resource uses, and mitigation concepts

3 LIST OF INFORMANT INTERVIEWS

Table 1.1 lists the organizations contacted, and persons interviewed by phone and/or in-person for the Land and Resource Use valued components.

Table 1 Interviews Conducted with Key Organizations

Valued Component	Organization	Person Interviewed
LAND AND RESOURCE USE		
Outdoor Recreation and Tourism	District of Hudson's Hope	Director of Public Works
	District of Taylor	Chief Administrative Officer
	B.C. Ministry of Environment Parks	Planning Section Head; Planning Officer
	B.C. Ministry of Forests, Lands and Natural Resource Operations	Land and Resource Specialist, Northeast Resource; Recreation Officer, Peace/Fort Nelson Recreation District
	Northern B.C. Tourism Association	Community Development
	Fort St. John & District Chamber of Commerce	Manager
	Dawson Creek Chamber of Commerce	Manager
	Dawson Creek Sportsman's Club	President
	Quality Inn Northern Grand	General Manager
	Pomeroy Inn and Suites	General Manager
	Custom River Adventures	Owner/operator; Tourism operator
	Peace Country River Rats	Communications; member
	Peace River Regional District	Land Use Planner
	Northland Trailblazers (FSJ snowmobile club)	President; members
	North Peace Rod and Gun Club	President
	Chetwynd Snowmobile Club	Past President; Director
	Chetwynd Rod and Gun Club	Member
	Moose ATV Club (Fort St. John)	President
	Tourism Dawson Creek	Manager
	Whiskey Jack Nordic Ski Club (Fort St. John)	President
Harvesting of Fish and Wildlife Resources	B.C. Ministry of Environment	Wildlife Biologist
	B.C. Ministry of Forest, Lands and Natural Resource Operations	Director of Environmental Assessment, Fish and Wildlife; Environmental Assessment Coordinator; Fisheries staff
	Go Fish	Staff
	Hudson's Hope Rod and Gun Club	Members; President
	Dawson Creek Sportsman's Club	Members
	North Peace Rod and Gun Club	Members; President
	Chetwynd & District Rod and Gun Club	Members; Treasurer
	Guide outfitters	Tenure holders
	Trappers	Trapline holders

Valued Component	Organization	Person Interviewed
Oil and Gas and Energy	B.C. Oil and Gas Commission	Executive Operations Manager
	B.C. Ministry of Energy and Mines Petroleum and Natural Gas Titles Branch	Executive Director; Director of Resource Development
	Energy Services B.C.	Executive Director South Fort St. John
	Talisman Energy	Fort St. John Superintendent
Forestry	B.C. Ministry of Forests, Lands and Natural Resource Operations	Land and Resource Specialist; Project Manager - Northeast Authorization
Minerals and Aggregates	B.C. Ministry of Transportation and Infrastructure	Manager, Regional Aggregate Resources
	Kennecott Canada Exploration (Rio Tinto)	Project Geologist
Navigation	Alberta Ministry of Transportation	Tompkins Landing Ferry Maintenance Contractor Inspector for Alberta Transportation; Shaftesbury Ferry Maintenance Contractor Inspector
	Nav Canada	Supervisor, Land Use Office, Aeronautical Information Services
	Transport Canada	Senior Airspace Specialist
	City of Fort St. John	City Manager
	District of Hudson's Hope	Administrator
	Peace River Regional District	Manager of Community Services
	District of Taylor	Administrator; Public Works Superintendent; Parks and Facilities Coordinator
	North Peace Regional Airport	Managing Director; Manager Finance and Administration
	Peace Country River Rats	Member

4 INTERVIEW PROCEDURES

The following procedures were carried out to guide BC Hydro and the Economic, Land and Resource Use, Social and Human Health Assessment Team (assessment team) in contacting organizations, interview logistics and interview implementation:

- **Introductory Contact from BC Hydro:** In certain cases, BC Hydro provided an introductory letter or call to the identified agency, industry and non-government representative contact, outlining the purpose of the Economic, Land and Resource Use, Social and Human Health assessment for the Project, the general method for carrying out the assessment, names of the assessment team and interviewer(s) that would be in touch with them to request an interview, anticipated date of initial contact and a request to indicate their (or a colleague's) interest in participating.
- **Introduction to Municipalities and Key Agencies:** For municipalities, a letter or verbal notification was provided by BC Hydro to the Chief Administrative Officer (CAO) with the above information, and a request to the CAO on the appropriate process for the assessment team to initiate contact with municipal representatives.

For key agencies such as Northern Health, a similar introductory letter was sent to senior managers.

- **Joint Meeting:** In some cases, a joint meeting with BC Hydro, the interviewer and the contact person of an organization was held if BC Hydro had not yet met with the contact or organization, or if the topic of discussion required provision of Project details.

In some cases, an introduction by BC Hydro to the assessment team Interviewer(s) was not required and the interviewer(s) proceeded directly with making contact.

Assessment team interviewers were provided with the following *Introduction Script*, to guide interviewers in contacting municipalities, key agencies and organizations.

- Introduction Script:
    - Hello, my name is ____
    - I am contacting you about the socio-economic assessment study for BC Hydro's proposed Site C Clean Energy Project. We would like to request an interview with you on (provide details on specific area of study such as community services, infrastructure, education, etc.) to inform our socio-economic assessment work for the Project. I will be in the Peace Valley region (Date). Can we set up a time to meet in person?

Assessment team interviewers were provided with the following Interview *Script* to guide Interviewers in conducting interviews:

- Interview Script:
    - Interviewer to introduce self
    - Thank interviewee for meeting to discuss (topic) in greater detail; provided background on how information will inform the socio-economic assessment work for BC Hydro's Site C Clean Energy Project
    - Interviewer to provide an outline of topics of discussion
    - Conduct interview
    - Interviewer to advise interviewee that he or she may be contacted again later in the study
    - Thank interviewee for their time
    - Provide contact information for self and BC Hydro in case of questions or interest in further follow-up

5 INTERVIEW DOCUMENTATION

Notes were made during each interview and submitted to BC Hydro as a Record of Contact for inclusion into BC Hydro's Record of Contact database. The Economic and Social Assessment Team also managed an Agency and Stakeholder Tracking Sheet to log information on economic and social interviews conducted including name of contact or organization, contact details (phone, email, address), which valued component interview was addressing and associated topic, date interview took place and by which assessment team interviewer.

APPENDIX C

Part 2 Land and Resource Management Plans and GIS Methodology

1 INTRODUCTION

This appendix outlines the land and resource management plans relevant for the Project. Information is presented on geographical or physical overlap with project components. Information is also included on the Geographic Information Systems (GIS) for the Land and Resource Use assessment including the purpose, methodology, data sources and indicators applied. GIS analysis utilizing government data bases and project spatial representation, was applied to identify the overlap. The appendix also presents the cumulative effects project inclusion database for the Peace River Regional District which is the largest regional assessment area for the land and resource use valued components (and the maximum area for consideration within the Land and Resource Use Cumulative Effects Assessment). The purpose of this appendix is to support Volume 3 Economic and Land and Resource Use Effects Assessment of the Site C Clean Energy Project EIS.

2 LAND AND RESOURCE MANAGEMENT PLANS

The provincial Crown land in the Project activity zone is subject to the strategies and objectives of land and resource management plans (LRMPs). The Project activity zone encompasses portions of both the Dawson Creek and Fort St. John land and resource management plans (LRMPs). Together the two plans cover 7.5 million hectares. The recommendations of the Fort St. John planning table were accepted in 1997, and those of the Dawson Creek table in 1999. The plans inform statutory decision makers in the exercise of their responsibilities.

The southern bank of the Peace River is roughly the boundary between the two plans, with the Dawson Creek LRMP area to the south and the Fort St. John LRMP area to the north.

Both LRMPs define the following five Resource Management Zones or land use zones:

- Agriculture and Settlement Zones – this includes Crown land inside an Official Community Plan area, and/or land managed by local government under the Local Government Act. It may be currently used for, or have potential future use for agriculture and range development. The category also includes agriculturally compatible activities such as mineral exploration, oil and gas development, transportation, utility and communication corridors, recreation development and forest management. This Resource Management Zone is distinct from the province's Agriculture Land Reserve, which takes precedence over the LRMP management zones.
- Protected Zones- applies to lands with high priority for natural, cultural, heritage and or recreation resource values. Land uses deemed compatible with these values may be permitted. These include non-commercial hunting and fishing, guide outfitting, trapping, grazing in support of guide outfitting, camping and hiking. Generally, extractive resource development is not permitted, which includes logging, mining, hydroelectric development, oil and gas exploration and development, although exceptions may be made in specific circumstances.

- Special Management Zones – applies to land with high priority for specific major resource values. Resource extraction is permitted, but must consider and address the priority values. The intent is to identify the risk to the priority values and manage potential conflicts. The priority values in the special management zones that fall within the Project activity zone are wildlife, recreation and river corridor.
- Enhanced Development – this applies to land for intensive resource development, with due consideration for the management of multiple uses. A high priority is combined resource management emphasis (e.g., high intensity forest management and range management).
- General Management Zone – applies to land where a wide range of resource uses are permitted. The objective is to integrate resource development with environmental and conservation values with limited land use conflict. Investment in resource development and enhancement is encouraged.

The distribution of the Project activity zone among the Resource Management Zones of the two land use plans is summarized in Table 1. Both LRMPs proposed a protected area that extends into the Peace River Boudreau Lake proposed protected area. The issuance of tenures for the use of Crown land or resources is informed by the resource management objectives of the Resource Management Zone within which the activity is proposed.

Two sub-regional planning initiatives have been undertaken since acceptance of the LRMPs. The Dunlevy Creek Management Plan - accepted by government in 2002 – provides specific management direction for oil and natural gas development and tenure disposition in the Dunlevy Creek Special Management Zone, which is located west of Hudson's Hope along the north shore of Williston Lake. The second planning initiative - which took place from 2004 to 2006 to address lands in the Project activity zone south of the Peace River - was the Peace-Moberly Tract Sustainable Resource Management Plan (SRMP). The purpose of this initiative – which involved the provincial government and the West Moberly and Saulteau First Nations – was to address land use issues of mutual concern to the parties. The SRMP recognized the recommendation of the Dawson Creek LRMP (i.e., a higher level plan) and specifically the proposed designation of the Peace River Boudreau Lake proposed protected area (BC Ministry of Natural Resource Operations 2006). The SRMP remains in draft form as it has not been formally accepted by the parties.

Table 1 Resource management zones in the Project activity zone and reservoir impact lines, (ha)

Resource Management Zone (RMZ)	5-Year Beach Line[a]	Site C Dam Site Area[b]	Transmission Line[c]	Construction Access Roads[d]	Quarried & Excavated Materials[e]	5-Year Beach Line to Outermost Impact Line[f]	Total RMZ in Plan Area	% Project overlap with RMZ
Dawson Creek LRMP[1]								
Enhanced - South Peace	765.7	105.8	608.0	35.3	178.1	127.7	152,379.5	1.2%
General - Multi Value Foothills	0.0	0.0	0.0	0.6	148.2	0.0	17,702.1	0.8%
General - Multi Value Plateau	0.0	206.7	384.7	13.6	0.0	609.6	103,162.4	1.2%
Proposed Protected Area	1,999.8	46.8	0.0	21.6	0.0	3,464.9	22,104.2	25.0%

Resource Management Zone (RMZ)	5-Year Beach Line[a]	Site C Dam Site Area[b]	Transmission Line[c]	Construction Access Roads[d]	Quarried & Excavated Materials[e]	5-Year Beach Line to Outermost Impact Line[f]	Total RMZ in Plan Area	% Project overlap with RMZ
Settlement	139.2	274.5	275.6	105.4	21.2	134.7	252,614.2	0.4%
Special - River Corridor	330.6	240.2	92.2	0.0	79.6	45.0	52,027.7	1.5%
Ft St John LRMP[2]								
Agriculture/Settlement	12.4	76.1	0.0	11.9	118.3	738.5	237,855.2	0.4%
General Management	0.0	0.0	0.0	0.0	0.0	46.9	50,182.1	0.1%
Proposed Protected Area	782.2	64.9	0.0	0.0	0.0	0.0	2,097.2	40.4%
Special Management	5,510.3	638.2	0.0	224.7	85.2	3,498.6	82,358.4	12.1%

NOTE:

[a] 5-year Beach Line is the predicted extent of shoreline retreat at the Maximum Normal Reservoir Level five years after impoundment of the proposed reservoir as defined in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports, Part 2 Preliminary Reservoir Impact Lines.

[b] Site C dam site and substation construction areas and restricted access zones as described in Section 4 Project Description.

[c] Transmission line corridor and onetime clearing areas as described in Section 4 Project Description.

[d] Permanent and temporary roads, Highway 29 realignment as described in Section 4 Project Description.

[e] Off-site construction material sources as described in Section 4 Project Description.

[f] 5-Year Beach Line to outermost impact line including the stability impact line, landslide generated wave impact or flood impact line as defined in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports, Part 2 Preliminary Reservoir Impact Lines.

[1 2] only RMZ's in Dawson Creek and Fort St. John LRMPs that overlap the Project activity zone are reported

SOURCE:

Hillcrest geographics (2012)

3 GEOGRAPHIC INFORMATION SYSTEM ANALYSIS

3.1 Purpose

Geographical Information System (GIS) analysis is able to integrate and relate any data with a spatial component either numerically or through mapping. GIS analysis can assist with determining the spatial extent of change on the land base and how change could interact with other interests.

The GIS developed for the Project provides a window to data and information sources provided by government. The majority of the data used is from the Land and Resource Data Warehouse. Other data was provided by BC Hydro and local government.

3.2 Methodology

Resource values on the land base can be identified and expressed quantitatively, usually by area or count, and by Project activity zone component as described in Section 4 Project Description. Table 2 summarizes the categories used to assign values to spatial components in the Project activity zone. The categories correspond to table headings used in the presentation of GIS results. All geographical reference data for the

Project footprint was provided by BC Hydro and included the 461.8 m Site C Maximum Normal Reservoir Level.

Table 2 Definition of GIS categories

Project Component Hierarchy	Description	Hectares
5-Year Beach Line	5-year Beach Line is the predicted extent of shoreline retreat at the Maximum Normal Reservoir Level five years after impoundment of the proposed reservoir as defined in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports, Part 2 Preliminary Reservoir Impact Lines	9,540.2
Site C Dam Site Area	Site C dam site and substation construction areas and restricted access zones	1,653.2
Transmission Line	Transmission line corridor and onetime clearing areas	1,360.5
Construction Access Roads	Permanent and temporary roads, Highway 29 realignment	413.0
Quarried and Excavated Materials	Off-site construction material sources	734.6
5-Year Beach Line to Outermost Impact Line	5-Year Beach Line to outermost impact line including the stability impact line, landslide generated wave impact or flood impact line as defined in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports, Part 2 Preliminary Reservoir Impact Lines	8,665.9
Total		**22,367.4**

3.3 List of Indicators and Data Sources

The list of indicators included in the GIS is shown in column 1 of Table 3. The indicators were selected based on a consideration of resources and values that might reasonably be expected to be affected by the Project. The indicators relate mainly to land ownership status, geographical features, built facilities and infrastructure, designations made in the land and resource management planning process and rights granted by government tenure.

The data sources for the GIS indicators are listed in Table 3. Data retrieval was undertaken primarily during October, 2012. Other field references, including the field list, source path and metadata reference are included in the GIS output itself.

Table 3 GIS data sources

Indicator	Source Path	Metadata	Date Accessed
Agricultural Land Reserve	$LOCAL\ALC_AGRI_LAND_RESERVE_POLYS	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=3553&recordSet=ISO19115	23/04/2012
ARIS	-	http://www.empr.gov.bc.ca/Mining/Geoscience/MapPlace/metadata/Pages/ARIS_Metadata.aspx	12/11/2012
Biogeoclimatic Zones	$BCGW\WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51819&recordSet=ISO19115	12/11/2012
Coal Bed Methane Potential	$BCGW\WHSE_MINERAL_TENURE.GEOL_COAL_BED_POLY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=17790&recordSet=ISO19115	12/11/2012
Coal Tenures	$LOCAL\COAL_APPLICATION	data accessed here: http://www.empr.gov.bc.ca/Titles/MineralTitles/gis/Pages/Download.aspx	23/04/2012
Crown Reversions	$BCGW\WHSE_TANTALIS.TA_REVERSION_SHAPES	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4053&recordSet=ISO19115	12/11/2012
Ecosections	$BCGW\WHSE_TERRESTRIAL_ECOLOGY.ERC_ECOSECTIONS_SP	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=46476&recordSet=ISO19115	12/11/2012
Environmental Remediation Sites	$BCGW\WHSE_WASTE.SITE_ENV_REMEDIATION_SITES_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=38531&recordSet=ISO19115	12/11/2012
Forest Cover	$BCGW\WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=36031&recordSet=ISO19115	12/11/2012
FTEN - Community Forests and Woodlots	$BCGW\WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51020&recordSet=ISO19115	12/11/2012
FTEN - Cut Blocks	$BCGW\WHSE_FOREST_TENURE.FTEN_CUT_BLOCK_POLY_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=50580&recordSet=ISO19115	12/11/2012
FTEN - Free Use Permit	$BCGW\WHSE_FOREST_TENURE.FTEN_FREE_USE_PERMIT_POLY_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51019&recordSet=ISO19115	12/11/2012
FTEN - Recreation Reserves, Recreation Sites	$BCGW\WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51178&recordSet=ISO19115	12/11/2012
FTEN - Recreation Trail	$BCGW\WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51158&recordSet=ISO19115	12/11/2012
FTEN - Roads	$BCGW\WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=50818&recordSet=ISO19115	12/11/2012
FTEN - Special Use Permits	$BCGW\WHSE_FOREST_TENURE.FTEN_SPEC_USE_PERMIT_POLY_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51945&recordSet=ISO19115	12/11/2012
Guide Outfitter Areas	$BCGW\WHSE_WILDLIFE_MANAGEMENT.WAA_G	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recor	12/11/2012

Indicator	Source Path	Metadata	Date Accessed
	UIDE_OUTFITTER_AREA_SVW	dUID=7510&recordSet=ISO19115	
Indian Reserves	$DSSWHSE\firstnat\indian_reserves\tir_bc.gdb\tir_bc\tir_bc	-	12/11/2012
Known Fish Observations	$BCGW\WHSE_FISH.FISS_FISH_OBSRVTN_PNT_SP	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=43471&recordSet=ISO19115	12/11/2012
Land Act Tenures and Applications	$BCGW\WHSE_TANTALIS.TA_CROWN_TENURES_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4049&recordSet=ISO19115	12/11/2012
Land Use - Baseline Thematic Mapping	$BCGW\WHSE_BASEMAPPING.BTM_PRESENT_LAND_USE_V1_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=37011&recordSet=ISO19115	12/11/2012
Licensee Operating Areas - Coniferous	$LOCAL\OPERATINGAREAS_CONIF	na - provided by Rob Schuetz Oct 2011	01/10/2011
Licensee Operating Areas - Deciduous	$LOCAL\OPERATINGAREAS_DECID	na - provided by Rob Schuetz Oct 2011	01/10/2011
Limited Entry Hunting Zones	$BCGW\WHSE_WILDLIFE_MANAGEMENT.WAA_LTD_HNT_ZONE_CURR_YEAR_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=45594&recordSet=ISO19115	12/11/2012
LRMP Zoning - Dawson Creek	$LOCAL\LRMP_DDC	ftp://ftpprg.env.gov.bc.ca/pub/outgoing/srm/rii/arc/landuse/rmz/	01/06/2008
LRMP Zoning - Fort St John	$LOCAL\LRMP_DJO	ftp://ftpprg.env.gov.bc.ca/pub/outgoing/srm/rii/arc/landuse/rmz/	01/06/2008
Mineral Reserves	$BCGW\WHSE_MINERAL_TENURE.MTA_SITE_POLY	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=34051&recordSet=ISO19115	12/11/2012
Mineral Reserves - categorized	$BCGW\WHSE_MINERAL_TENURE.MTA_SITE_POLY	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=34051&recordSet=ISO19115	12/11/2012
Mineral Tenures	$BCGW\WHSE_MINERAL_TENURE.MTA_ACQUIRED_TENURE_POLY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=33850&recordSet=ISO19115	12/11/2012
MinFile	$BCGW\WHSE_MINERAL_TENURE.MINFIL_MINERAL_FILE	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=3955&recordSet=ISO19115	12/11/2012
Mountain Pine Beetle Infestation	$LOCAL\MOUNTAIN_PINE_BEETLE	http://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/2010/	23/04/2012
Municipalities	$BCGW\WHSE_TANTALIS.TA_MUNICIPALITIES_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=50339&recordSet=ISO19115	12/11/2012
OGC Petroleum Development Roads	$BCGW\WHSE_MINERAL_TENURE.OG_PETRLM_DEV_ROADS_PUB_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58803&recordSet=ISO19115	12/11/2012
OGC Pipeline Rights-of-Way	$BCGW\WHSE_MINERAL_TENURE.OG_PIPELINE_RW_GOV_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58740&recordSet=ISO19115	12/11/2012
OGC Unconventional Play Trends	$BCGW\WHSE_MINERAL_TENURE.OG_UNCONVENTNL_PLAY_TRENDS_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58863&recordSet=ISO19115	12/11/2012

Indicator	Source Path	Metadata	Date Accessed
Oil and Gas Facilities	$BCGW\WHSE_MINERAL_TENURE.OG_FACILITY_LOCATIONS_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58739&recordSet=ISO19115	12/11/2012
Oil and Gas Fields	$BCGW\WHSE_MINERAL_TENURE.OG_OIL_AND_GAS_FIELDS_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58860&recordSet=ISO19115	12/11/2012
Oil and Gas Well Surface locations	$BCGW\WHSE_MINERAL_TENURE.OG_SURFACE_HOLE_STATUS_SP	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=48574&recordSet=ISO19115	12/11/2012
Old Growth Management Areas	$BCGW\WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51680&recordSet=ISO19115	12/11/2012
Ownership	$LOCAL\OWNERSHIP	na - provided by BC Hydro.	23/04/2012
PNG Tenures	$BCGW\WHSE_MINERAL_TENURE.PTSA_PETROLEUM_TITLE_POLY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=45934&recordSet=ISO19115	12/11/2012
Potential Recreation Sites	$LOCAL\POTENTIAL_REC_SITES	-	23/04/2012
Private Aggregate Pits	$BCGW\WHSE_MINERAL_TENURE.MMS_NOTICE_OF_WORK	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=59779&recordSet=ISO19115	12/11/2012
Protected Areas - Existing (Provincial)	$BCGW\WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=3997&recordSet=ISO19115	12/11/2012
Protected Areas - Proposed	$LOCAL\PROPOSED_PROTECTED_AREAS	provided by Jennifer Brooks, ILMB	01/06/2008
Pulpwood Agreements	$BCGW\WHSE_ADMIN_BOUNDARIES.FADM_PULPWOOD_AGREEMENT	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=3721&recordSet=ISO19115	12/11/2012
Range Opportunities - Potential	$LOCAL\RANGE_OPPORTUNITIES	na - provided by Gwen Brace MoF, 2008 (identifed as having no significant changes by Craig Hartel, Sept 2011)	01/06/2008
Range Tenures	$BCGW\WHSE_FOREST_TENURE.FTEN_RANGE_POLY_SVW	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51041&recordSet=ISO19115	12/11/2012
Rec/Tourism - Features	$DSSWHSE\tourism\featurepoint\point	http://ilmbwww.gov.bc.ca/cis/initiatives/tourism/index.html	12/11/2012
Rec/Tourism - Travel Routes	$DSSWHSE\tourism\featureline\arc	http://ilmbwww.gov.bc.ca/cis/initiatives/tourism/index.html	12/11/2012
Rec/Tourism Facilities	$DSSWHSE\tourism\facility\point	http://ilmbwww.gov.bc.ca/cis/initiatives/tourism/index.html	12/11/2012
Recreation Features Inventory	$BCGW\WHSE_FOREST_VEGETATION.REC_FEATURES_INVENTORY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4021&recordSet=ISO19115	12/11/2012
Recreation Opportunity Spectrum	$BCGW\WHSE_FOREST_VEGETATION.REC_OPPORTUNITY_SPECTRUM_INV	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4013&recordSet=ISO19115	12/11/2012
Timber Harvesting Land Base	$LOCAL\THLB	P:\prg\arc\landuse\thlb\thlb_ddc\polygon, thlb_djo\polygon	23/04/2012
Timber Supply Areas (TSA)	$BCGW\WHSE_ADMIN_BOUNDARIES.FADM_TSA	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32471&recordSet=ISO19115	23/04/2012

Indicator	Source Path	Metadata	Date Accessed
Traplines	$BCGW\WHSE_WILDLIFE_MANAGEMENT.WAA_TRAPLINE_AREAS_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=35836&recordSet=ISO19115	12/11/2012
Tree Farm Licences (TFL)	$BCGW\WHSE_ADMIN_BOUNDARIES.FADM_TFL	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=3731&recordSet=ISO19115	12/11/2012
TRIM Buildings (count of polygons)	$BCGW\WHSE_BASEMAPPING.TRIM_EBM_BUILDINGS	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32471&recordSet=ISO19115	12/11/2012
TRIM Cultural Points	$BCGW\WHSE_BASEMAPPING.TRIM_CULTURAL_POINTS	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32471&recordSet=ISO19115	12/11/2012
TRIM Transportation Lines	$BCGW\WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32471&recordSet=ISO19115	12/11/2012
VIMS Established Visual Quality Objective - VLI	$BCGW\WHSE_FOREST_VEGETATION.REC_VIMS_EVQO_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51898&recordSet=ISO19115	12/11/2012
VIMS Visual Landscape Inventory - VLI	$BCGW\WHSE_FOREST_VEGETATION.REC_VIMS_VLI_SVW	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=51900&recordSet=ISO19115	12/11/2012
Visual Landscape Inventory	$BCGW\WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4021&recordSet=ISO19115	12/11/2012
Water Licences	$BCGW\WHSE_WATER_MANAGEMENT.WLS_POD_LICENCE_SP	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=47674&recordSet=ISO19115	12/11/2012

SOURCE:
Hillcrest Geographics (2012)

1 **Table 3 GIS data from BC Hydro**

Indicator	Source Path	Metadata	Date accessed
Boat Launches - point	$INFRASTRUCTURE\Recreation\Boat_Launch_Generation\BoatLaunch_Locations_pt_shp.shp	na	23/04/2012
Drinking Water Sources (Surface Water PODs)	$INFRASTRUCTURE\Water_Act\WLS_POD_DS.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=50000&recordSet=ISO19115	23/04/2012
Fortis distribution pipe	$INFRASTRUCTURE\Utilities\Fortis\distribution_pipe.shp	na	23/04/2012
Fortis distribution stations	$INFRASTRUCTURE\Utilities\Fortis\distribution_stations.shp	na	23/04/2012
Fortis distribution valves	$INFRASTRUCTURE\Utilities\Fortis\distribution_valves.shp	na	23/04/2012
Fortis transmission pipe	$INFRASTRUCTURE\Utilities\Fortis\transmission_pipe.shp	na	23/04/2012
Fortis transmission pipeline facility	$INFRASTRUCTURE\Utilities\Fortis\transmission_pipeline_facility_location.shp	na	23/04/2012
Fortis transmission valves	$INFRASTRUCTURE\Utilities\Fortis\transmission_valves.shp	na	23/04/2012
OGC Ancillary and Other Applications	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\ANC_OT_APP\ANC_OT_APP.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58679&recordSet=ISO19115	23/04/2012
OGC Engineering Projects	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_ENG_PRJ\OG_ENG_PRJ.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58879&recordSet=ISO19115	23/04/2012
OGC Facilities	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Geomatics_Data_Management\OGC_Facilities_22_Dec_2011_subset.shp	na	23/04/2012
OGC Facility Locations	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_FAC_LOC\OG_FAC_LOC.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58739&recordSet=ISO19115	23/04/2012
OGC Facility Sites	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_FAC_STS\OG_FAC_STS.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58700&recordSet=ISO19115	23/04/2012
OGC Geophysical	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_GEOPHY\OG_GEOPHY_line.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58759&recordSet=ISO19115	23/04/2012
OGC Geophysical Ancillary Features	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\GEOP_ANC_L\GEOP_ANC_L.shp	na	23/04/2012
OGC Oil and Gas Fields	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_FIELDS\OG_FIELDS.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58860&recordSet=ISO19115	23/04/2012
OGC Petroleum Development Roads	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\PET_D_RDS\PET_D_RDS_line.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58802&recordSet=ISO19115	23/04/2012
OGC Petroleum	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\D	http://apps.gov.bc.ca/pub/geometadata/metadataD	23/04/2012

Indicator	Source Path	Metadata	Date accessed
Development Roads Pre-2006	V_RDS_06\DV_RDS_06_line.shp	etail.do?recordUID=58804&recordSet=ISO19115	
OGC Pipeline Rights-of-Way	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_PIPE_LN\OG_PIPE_LN.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58740&recordSet=ISO19115	23/04/2012
OGC Pipelines	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Geomatics_Data_Management\OGC_Pipelines_22_Dec_2011_subset.shp	na	23/04/2012
OGC Section 8 Point Locations	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\SEC_8_LOC\SEC_8_LOC.shp	na	23/04/2012
OGC Section 9 Point Locations	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\SEC_9_PN_L\SEC_9_PN_L.shp	na	23/04/2012
OGC Sump Locations	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_SUMP_LC\OG_SUMP_LC.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58520&recordSet=ISO19115	23/04/2012
OGC Transportation	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Geomatics_Data_Management\OGC_Transportation_22_Dec_2011_subset.shp	na	23/04/2012
OGC Waste Disposal Sites	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\WATE_DISP\WATE_DISP.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58539&recordSet=ISO19115	23/04/2012
OGC Well Bottom Hole Event	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\BOT_HOL_EV\BOT_HOL_EV.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=48594&recordSet=ISO19115	23/04/2012
OGC Well Bottom Hole Status	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\BOT_HOL_ST\BOT_HOL_ST.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=48614&recordSet=ISO19115	23/04/2012
OGC Well Sites	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\OG_WELL_ST\OG_WELL_ST.shp	http://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=58219&recordSet=ISO19115	23/04/2012
OGC Well Surface Hole Event	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\SUR_HOL_EV\SUR_HOL_EV.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=48554&recordSet=ISO19115	23/04/2012
OGC Well Surface Hole Status	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\SUR_HOL_ST\SUR_HOL_ST.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=48574&recordSet=ISO19115	23/04/2012
Points of Diversion with Water Licence Info	$INFRASTRUCTURE\Water_Act\WLS_PDL_SP.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=47674&recordSet=ISO19115	23/04/2012
Rec sites	$INFRASTRUCTURE\Recreation\Recreation_Use_Study_2008-2009_LGL\BC_Hydro_LGL_Rec_Sites.shp	na	23/04/2012
Shaw manholes	$INFRASTRUCTURE\Utilities\Shaw\manhole	na	23/04/2012
Shaw poles	$INFRASTRUCTURE\Utilities\Shaw\pole	na	23/04/2012
Shaw telecom facilities	$INFRASTRUCTURE\Utilities\Shaw\telcom_facility	na	23/04/2012

Indicator	Source Path	Metadata	Date accessed
Shaw telecom underground lines	$INFRASTRUCTURE\Utilities\Shaw\telcom_ug_line	na	23/04/2012
Spectra gas facility - point	$INFRASTRUCTURE\Utilities\Spectra\GAS FACILITY POINT.shp	na	23/04/2012
Spectra gas facility - poly	$INFRASTRUCTURE\Utilities\Spectra\GAS FACILITY POLY.shp	na	23/04/2012
Spectra km post	$INFRASTRUCTURE\Utilities\Spectra\KM POST.shp	na	23/04/2012
Spectra pipeline	$INFRASTRUCTURE\Utilities\Spectra\PIPELINE.shp	na	23/04/2012
TANTALIS - Surveyed Wellsites	$INFRASTRUCTURE\Oil_Gas_Infrastructure\Oil_Gas_Commission\TA_WEL_SVW\TA_WEL_SVW_point.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=4057&recordSet=ISO19115	23/04/2012
Telus telcom facility	$INFRASTRUCTURE\Utilties\Telus\BC_ICIS_TELCOM_FACILITY	na	23/04/2012
Telus telcom structure	$INFRASTRUCTURE\Utilties\Telus\BC_ICIS_TELCOM_STRUCTURE	na	23/04/2012
Telus wire cables	$INFRASTRUCTURE\Utilities\Telus\BC_ICIS_CABLE_WIRE	na	23/04/2012
Water Licensed Works - Lines	$INFRASTRUCTURE\Water_Act\WLS_WLN_SP_line.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32751&recordSet=ISO19115	23/04/2012
Water Licensed Works - Points	$INFRASTRUCTURE\Water_Act\WLS_WLO_SP.shp	https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=32752&recordSet=ISO19115	23/04/2012

SOURCE:
Hillcrest Geographics (2012)

4 REFERENCES

4.1 Literature Cited

Hillcrest Geographics. 2012. *Geographic Information Systems Analysis of Project Activity Zone*. Unpublished database on file at BC Hydro. Vancouver, BC.

APPENDIX C

Part 3 Oil, Gas and Energy Exploration and Production Activity

1 INTRODUCTION

This Appendix provides additional information on petroleum and natural gas exploration and production activity in B.C., with a particular focus on the Montney Play region in the Northeast. The purpose of this appendix is to support Volume 3 Section 22 Oil, Gas and Energy of the Site C Clean Energy Project EIS.

2 PRODUCTION AND TENURES

2.1 Provincial Production

Recent years have seen a favorable investment climate, and receptive government policies (e.g., summer drilling program, deep drilling program, royalty rebates) that have spurred exploration and development of natural gas and other hydrocarbon resources. Industry growth has occurred despite historically low gas prices.

Petroleum and Natural Gas (PNG) tenures, drilling and production activity for the B.C. industry is shown in Table 1. Tenure activity varied widely during the nine-year period ending in 2010 with peak disposition by area in 2002 and peak tender bonus receipts in 2008, when the province received a record $2.66 billion in revenues. Dispositions have dropped dramatically since 2008, as have the average price paid per hectare, but the latter remains well above pre-2007 levels.

Drilling activity peaked in 2006 and has been declining steadily since even though production activity has increased. While the number of producing oil wells has remained relatively stable over the nine years ending in 2010, the number of producing gas wells has more than doubled from 3,066 in 2002 to 7,307 in 2010.

Table 1 Petroleum and natural gas tenures, drilling and production activity statistics for B.C., 2002–2010

Tenures	2002	2003	2004	2005	2006	2007	2008	2009	2010
PNG Rights Dispositions									
Hectares disposed	848,917	733,487	540,427	579,402	690,744	595,559	756,752	389,146	381,132
Total Tender Bonus ($millions)	$289	$647	$232	$534	$630	$1,047	$2,662	$893	$844
Average Price ($/ha)	$340	$882	$430	$922	$912	$1,758	$3,518	$2,295	$2,216
Drilling Activity									
Wells drilled	580	1032	1117	1202	1313	827	805	667	554
Production Activity									
Producing oil wells	1,045	1,085	1,110	1,092	1,122	1,078	1,061	1,043	1,026
Producing gas wells	3,066	3,569	4,385	5,217	6,608	6,607	7,157	7,129	7,307

SOURCES:
BCMEMNG (2011A); CAPP (2011)

Expenditures by the petroleum industry in B.C. during a nine-year period ending in 2009 are presented in Table 2. Total expenditures climbed 44%, with increases experienced in exploration (80%), development (56%) and operations (127%). Royalties to

government fluctuated during this period due primarily to changes in gas prices. Prices in late 2010 were trending around $4 per million British Thermal Units versus a peak of $16 in 2006. In 2009, royalties were roughly one third their peak in 2006. Crown royalties contribute to the provincial treasury as well as regional finances through the Fair Share Agreement with the province. This program sees a portion of resource revenues shared with the local governments (refer to Government Finances analysis in Section 16 Local Government Revenue).

Table 2 Net cash expenditures of the petroleum industry in B.C., 2001–2009 ($millions)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009
Exploration									
Geological & geophysical	149	178	200	239	237	280	186	181	123
Drilling	511	389	640	640	542	916	957	1,133	995
Land	489	335	689	290	599	700	1,109	2,728	953
Total	**1,148**	**902**	**1,530**	**1,170**	**1,378**	**1,896**	**2,252**	**4,042**	**2,071**
Development									
Drilling	1,117	783	1,388	1,702	2,444	2,721	2,012	2,403	1,908
Field equipment	665	525	662	849	972	1,321	1,113	1,315	1,012
Enhanced Oil Recovery	5	5	0	0	3	10	8	10	0
Gas plants	195	205	206	177	137	146	117	110	182
Total	**1,982**	**1,518**	**2,257**	**2,728**	**3,555**	**4,198**	**3,250**	**3,837**	**3,102**
Operating									
Wells and flow lines, etc.	607	778	784	871	992	1,136	1,153	1,193	1,236
Gas plants	155	178	220	247	275	331	352	375	490
Total	762	956	1,004	1,118	1,267	1,467	1,504	1,568	1,726
Royalties	1,246	906	1,413	1,508	1,967	1,444	1,255	1,370	500
Total Expenditures	**5,137**	**4,281**	**6,204**	**6,523**	**8,167**	**9,005**	**8,261**	**10,817**	**7,399**

SOURCE:
CAPP (2011)

The value of producers' sales is shown in Table 3. In 2009, natural gas accounted for approximately 75% of all commodity sales, slightly below its average share of 81% for the nine-year period ending in 2009. Other hydrocarbons have increased their share of total sales in the latter part of this period although their combined contribution remains less than 15%. Oil and condensate sales held a relatively constant share of around 10%.

Table 3 Value of B.C. producers' sales, 1997–2006 ($millions)

Commodity	2001 ($)	2002 ($)	2003 ($)	2004 ($)	2005 ($)	2006 ($)	2007 ($)	2008 ($)	2009 ($)
Crude oil and condensate	593	577	669	749	849	803	758	955	572
Natural gas	4,853	3,529	5,526	5,877	8,004	6,576	6,429	7,978	3,978
Pentanes plus	134	139	137	169	213	224	199	259	194
Propane	72	53	80	70	91	96	114	70	80
Butanes	50	56	73	86	85	101	128	136	116
Sulphur	0	2	8	6	15	9	14	258	241
Ethane	120	152	196	174	245	224	250	319	147
Total	**5,823**	**4,508**	**6,688**	**7,130**	**9,501**	**8,034**	**7,892**	**9,974**	**5,328**

SOURCE:
CAPP (2011)

2.2 Regional Production

The Montney Play region is one of Northeast's most active exploration and development areas, accounting for close to 50% of total provincial value of petroleum and natural gas tender bonuses in 2009. The region is approximately 7,669 square km extending from north central Alberta to the northwest of Fort St. John, and includes the area under the Peace River between Fort St. John and Hudson's Hope. The main Montney producing area is approximately 1 million hectares, located south of the Peace River in the South Peace region. The gas-in-play estimates of commercially viable gas amount to 250 trillion cubic feet (BCMEMPR 2010b).

2.3 Local Assessment Area Tenure Process

The province holds monthly public sealed bidding competitions for companies seeking to acquire the rights to petroleum and natural gas tenures. B.C. uses three types of agreements:

- permits, which carry an obligation to conduct exploration
- drilling licences, conveying the exclusive right for permission to drill oil and gas wells in a defined area
- leases, allowing production and exclusive drilling rights

Oil companies, or agents acting on their behalf (e.g., land companies) will request specific parcels for posting. Upon receiving a request, the Ministry of Energy, Mines and Natural Gas initiates a referral process through which government agencies, local governments and First Nations have the opportunity to provide comments. The referral process may include caveats or development considerations as part of the parcel posting. Common consultation caveats include directives for the use of directional drilling within the proposed Peace River Boudreau Lake protected area (see Volume 3 Section 22 Figure 22.3) and restrictions on access and well site construction within the Order In Council (OIC) reserve. Any licensee bidding on rights within the OIC reserve would be made aware through the bid notice of the possibility of flooding (OGC, Area Director 2008 pers. comm.).

Petroleum and natural gas tenures may contain rights to all resources beneath the surface that are located within the tenure's parcel description, or tenures may convey the right to specific geological zones only. Petroleum and natural gas zones are packages of one or more geological formations believed to contain petroleum and natural gas resources. As a result, an area of land at its surface may have two or more overlapping subsurface petroleum and natural gas tenures with rights to different geological zones (BCMEMNG 2011b).

3 REFERENCES

3.1 Literature Cited

British Columbia Ministry of Energy, Mines and Natural Gas (BCMEMNG). 2011a. *Sales Results and Statistics*. Unpublished database on file at BC Ministry of Energy, Mines and Natural Gas. Victoria, BC.

British Columbia Ministry of Energy, Mines and Natural Gas (BCMEMNG). 2011b. *Discussion Paper on the Tenure Provisions of the Petroleum and Natural Gas Act and Regulations*. Titles and Corporate Relations Division. Victoria, BC.

Canadian Association of Petroleum Producers (CAPP). 2011. *TECHNICAL REPORT Statistical Handbook for Canada's Upstream Petroleum Industry*. Calgary, AB.

3.2 Personal Communications

Oil and Gas Commission (OGC). 2008. Area Director, Roger St. Jean. Telephone interviews. November 26 and December 3, 2008.

APPENDIX C

Part 4 Harvest of Fish and Wildlife Resources

1 INTRODUCTION

This appendix provides additional baseline information on the harvesting of fish and wildlife resources in the Peace Region (i.e., fishing, hunting, trapping and guide outfitting). For fishing, specific consideration is given to the fishing resource base, license sales, fishing activity, angler expenditures and the angling profile for the Peace Region. For hunting, specific consideration is given to hunting and season limits, license sales and hunting activity. For trapping, specific consideration is given to trapping activity and harvests. For guide outfitting, specific consideration is given to the guide outfitting industry and quotas and harvests for guide outfitters. The purpose of this appendix is to support Section 24 Harvest of Fish and Wildlife Resources of the Site C Clean Energy Project EIS.

2 FISHING

For this baseline, fishing is defined as an activity that users value and undertake as a recreation experience. Anglers may be participating in fishing only, or they may be fishing in conjunction with other outdoor recreation activities, such as camping and boating.

Anglers may be from the local area or visitors from outside the region. A distinction between resident anglers and non-residents anglers is made to identify the proportion of activity classified as tourism. Anyone who travels more than 80 km from home is considered a tourist, while a person travelling less is classified as a resident angler.

Any reference to the fishing “industry” is in accordance with the definition by BC Stats and the B.C. Ministry of Environment (BCMOE). These are establishments that sell directly to anglers, including angling guides and charters, resorts and fish camps, boat rentals and marinas, retail outlets such as tackle shops, transportation companies and the hospitality sector (e.g., hotels, campgrounds, restaurants). Establishments engaged in manufacturing and wholesaling that sell indirectly to anglers are not covered.

Typically, but not exclusively, packages that include angling guide services, air transportation and accommodations are purchased by tourists, although many tourists are self-sufficient and unlikely to hire a third party to package the fishing experience. Tourist anglers would be the primary client base of the guided fishing and lodge sector in the Peace region. Resident anglers would not be purchasing packages but would be buying major equipment such as boats. Both groups are assumed to purchase rod and gear, gasoline, rentals and miscellaneous services.

2.1 Fishing Resource Base

As indicated in Table 1, the fishing resource base in the Peace Region can be divided into three habitats: large lakes and reservoirs of greater than 400 hectares, small lakes, and river and streams. The large lakes are all located in the northern areas of the region in the Northern Rockies Regional District along with Dinosaur and Williston reservoirs. There are many small lakes in the sub-region, and they are predominantly in the Liard-Fort Nelson area. Northern pike, walleye, Dolly Varden and Arctic grayling are the main sport species. The stocked small lakes are usually replenished with rainbow trout. Major rivers include the Peace, Pine, Sukunka, Halfway, Beatton, Murray, Muskwa, Prophet,

Fort Nelson, Liard, Kechika, Turnagain and Sikanni Chief. Arctic grayling, Dolly Varden, mountain whitefish, rainbow trout, northern pike and inconnu generally occur throughout. Rainbow trout is limited to the Peace River, Dinosaur and Williston reservoirs and the Halfway River and its tributaries.

Table 1 Fisheries resource base in the Peace Region

Large Lakes and Reservoirs	Productive Small Lakes	Stocked Small Lakes	Mainstream River
5	50	16	1,935 km

NOTES:
The Peace region includes the Peace River Regional District and Northern Rockies Regional Municipality. Stocked means stocked within the last three years.

SOURCE:
Hammond (1980)

Popular fishing lakes in the North Peace include Charlie Lake, Inga Lake and Cecil Lake. There are also a number of popular fishing lakes in the South Peace including Sundance and Quality lakes. Moberly Lake, which formerly produced trophy-size lake trout, has been under a recovery management program since 2002, with a fishing ban instituted in 2005. Of the 55 lakes and streams in Northeast B.C. listed in BCMOE's Spring 2011 Stocking Summary, 13 of the 21 lakes and streams that are stocked are in the Peace River Regional District (RAA). They are Boot, Boulder, Chunamun, Heart, Inga, Iver, Moose, One Island, Pete, Quality, Stewart, Sundance and Wright lakes (BCMOE 2012a).

The Peace River and its tributaries support angling for a variety of sportfish including lake trout, northern pike, walleye, Arctic grayling, bull trout, rainbow trout and mountain whitefish, lake whitefish, kokanee, goldeye, and burbot (GSGislason 2009; LGL 2010). Tributaries within the LAA, or entering the LAA, that support angling include the Moberly, Halfway, Beatton, and Pine rivers and several smaller streams. The structure of fish communities in the Peace River undergoes a gradual shift from a cold, clear water sportfish community dominated by mountain whitefish in upstream areas (i.e., Arctic grayling, bull trout, kokanee, lake whitefish, lake trout, mountain whitefish, and rainbow trout) to a cool, turbid water fish community downstream of the Pine River confluence. The latter is more tolerant of elevated water temperatures and high sediment levels (i.e., burbot, goldeye, northern pike, yellow perch, and walleye). Species like kokanee, lake whitefish, and lake trout, although present in the Peace River, are more adapted to lake and reservoir conditions rather than riverine habitats.

The two existing reservoirs on the Peace River, the Williston and the Dinosaur, have good fishing opportunities. The fisheries in both reservoirs are managed through The Peace/Williston Fish & Wildlife Compensation Program. The program is a cooperative venture of BC Hydro, provincial fish and wildlife management agencies, First Nations, and surrounding community supported by funding from BC Hydro. The program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River. A creel survey was conducted in 2005 on Dinosaur Reservoir (Stiemer 2006). A typical angler on Dinosaur was a local or a B.C. resident, in a boat, with low to average angling skill and experience, and concerned more with overall experience (scenery, weather, socialization, etc.) than angling success. Anglers were often fishing as a secondary

activity to boating. The scenery and length of the reservoir made it ideal for boating and sightseeing. The existence of a municipal campground adjacent to the boat launch increased popularity on weekends with local families. Dinosaur Lake also attracts anglers who are generally stopping for one night on their way to or from Alaska.

The most recent creel report for Williston Reservoir was published in 1993 and based on data from a 1989 survey (Blackman and Newsholme 1993). The study identified a low number of anglers but noted that the large reservoir area and the nomadic nature of anglers made use estimates difficult. More recent recreation use monitoring program reports include information on boating access and use of the reservoir but do not document angler effort (Synergy Applied Ecology 2011). This program is a component of the Water Use Plan and supporting Water Licence Requirements for BC Hydro's Peace River generating facilities including Peace Canyon and G.M. Shrum.

2.2 Licence Sales

Licence sales for the Peace region and the province of B.C. are shown in Table 2. The number of licences sold in the Peace region was up 8% between 2000 and 2007, in contrast to the decline in provincial fishing licence sales of 6%. The low point in yearly sales for both the Peace region and the province was 2004. While licence sales are considered to be broadly indicative of regional fishing activity, they do not distinguish between resident and non-resident purchases, and do not indicate where the licensee actually fished. As with hunting licences, fishing licence sales indicate a general trend of sustained or increased interest in fishing in the Peace region compared to overall declines in the province.

Table 2 Fishing licence sales for the Peace Region and British Columbia, 2000-2009

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	% Change 2000-2007
Peace Region											
Licences sold	11,449	11,879	11,570	10,839	10,627	11,309	13,361	12,303	NA	NA	7%
Fee revenue	$175,412	$179,605	$175,923	$284,697	$284,670	$295,427	$357,341	$330,791	NA	NA	89%
British Columbia											
Licences sold - resident	278,646	285,517	275,554	276,206	248,052	251,993	260,135	261,505	246,388	287,561	-6%
Licences sold – non-resident	76,853	79,932	79,868	69,402	68,328	67,370	70,512	70,937	59,081	64,555	-8
Fee revenue ($'000)	$5,007	$5,069	$4,979	$7,796	$7,759	$7,601	$7,998	$7,883	NA	NA	57%

NOTES:
NA – data not available
% - percentage

SOURCES:
BCMOE (2009); BCMFLNRO, Environmental Assessment Coordinator (2011a, pers. comm.)

2.3 Fishing Activity

Fishing activity is determined by the availability of preferred species, productivity of the resource, the proximity and ease of access to that resource and the changing demographics and preferences of the angling community. Other attributes of the fishing experience are also important. Anglers fish for a variety of reasons. In B.C., the top three reasons were to relax, enjoy nature, and to get away. Family togetherness and fishing for a challenge were also highly rated. Less important to anglers were catching fish to eat, catching many fish or catching large fish (Go Fish BC 2012, pers. comm.).

Fishing levels are determined by participation rates, river access, resource productivity and management programs. The sport fishery serves mainly resident anglers, but non-residents also travel to the Peace on a regular basis, and some local resorts and campgrounds actively promote angling activities.

Historic estimates of fishing as a percentage of total outdoor recreation activity were as high as 16% (LGL 2010), and although these rates have leveled off somewhat, sport fishing remains one of the top-ten recreation activities in the RAA. In the 1996 B.C. Visitor Study of the Northeast region, 19% of all B.C. residents who visited the Peace region participated in fishing (Tourism BC 1998). In 2005, anglers visiting the Peace region from other parts of B.C. accounted for 20,530 angler days (GSGislason 2009). In the same year, anglers from within the Peace region accounted for 36,740 angler days.

At the provincial level, freshwater angling activity has been steadily declining over the last 25 years. The province supported 5.7 million angler-days in 1985, compared to 4.4 million in 2005 and 3.8 million in 2010. Demographic change, including an aging population and growing urban populations, may explain some of this decline. Competition from other outdoor activities has increased considerably, while increased costs, increased angling regulations and closures, and declining fish populations have affected angling behaviour (GSGislason 2003). A similar trend is seen across Canada, where the resident angler participation rate has been on the decline in most provinces and territories since 1985 (DFO 2007). Between 2005 and 2010, the numbers of active adult angler numbers have remained steady after years of low level declines (3.2 million in 2005 and 3.3 million in 2010) (DFO 2012).

In 2005, over 6,000 anglers fished in the Peace region of the province. Seventy-two percent were B.C. residents, 21% were other Canadians and 7% were non-Canadians. The total number of days fished was 69,350, or 11.3 days per angler (Table 3). Of the 152,000 fish caught, over 34,000 were kept, for a release rate of almost 80%. Total expenditures of $7.1M represented $1,156 per angler or almost $102 per angler-day (GSGislason 2009). Sport fishing activity seems to have remained steady in 2010. The Peace region represents close to one-fifth of the total land area of the province, but its share of total fishing activity is minor, 2% of anglers, just over 2% of fish caught and under 2% of expenditures.

Table 3 Peace Region sport fishing summary, 2005 and 2010

Summary Statistics	Peace Region		% of British Columbia Total	
	2005	2010	2005	2010
Active anglers	6,140	NA	2.3%	NA
Angler days	69,350	64,186	1.7%	1.7%
Fish kept	34,000	34,696	1.9%	1.5%
Fish released	118,000	126,990	1.9%	1.9%
Angler expenditures	$7.1M	NA	1.5%	NA

NOTES:
NA – data not available
SOURCES:
GSGislason 2009; Go Fish BC 2012, pers. comm.

The Peace region fishing activity trends between 1985 and 2005 indicate an overall decline in the number of anglers and fish caught. By 2000, fewer anglers were catching fewer fish, at a time when the regional population was growing steadily (Table 3). This might be evidence of a declining participation rate in the sport.

As indicated in Table 4, anglers living in the Peace region spent 83% of their angler days fishing in the Peace region. Over half of angler days in the Peace region were spent by Peace region residents. The Peace region recorded the lowest amount of angler days in the province, representing about 2% of angler days by B.C. residents and 2% of angler days by B.C. residents and visitors from outside the province and country.

Table 4 Regional pattern of B.C. freshwater angler days, 2005

Angler Residence	Angler Days by Fishing Region									
	VI	LM	TN	KO	CA	SK	OM	PE	OK	All
British Columbia	440,080	684,260	647,320	532,050	364,580	261,550	245,660	57,270	349,490	**3,582,260**
Vancouver Island (VI)	415,630	9,490	15,440	6,310	14,350	12,020	4,090	810	6,220	**484,360**
Lower Mainland (LM)	17,140	656,640	264,740	15,200	134,760	13,870	13,580	1,810	41,310	**1,159,050**
Thompson-Nicola (TN)	0	3,030	302,450	22,220	37,960	3,030	8,010	1,020	19,420	**397,140**
Kootenay (KO)	610	1,910	1,750	445,610	3,670	3,160	11,510	0	6,480	**474,700**
Cariboo (CA)	180	1,630	3,630	0	141,250	2,820	4,740	0	200	**154,450**
Skeena (SK)	0	0	510	1,830	1,940	171,800	7,040	100	710	**183,930**
Omineca (OM	3,770	3,600	2,850	1,020	14,880	41,770	186,090	16,690	760	**271,430**
Peace (PE)	0	210	2,600	710	90	200	3,560	36,740	0	**44,110**
Okanagan (OK)	2,750	7,750	53,350	39,150	15,680	12,880	7,040	100	274,390	**413,090**
Rest of Canada	8,330	7,470	18,430	85,320	16,640	34,140	19,930	11,210	6,560	**208,030**
Outside Canada	12,810	19,220	36,440	27,690	59,190	25,110	7,080	880	5,660	**194,080**
Total	**461,220**	**710,950**	**702,190**	**645,060**	**440,410**	**320,800**	**272,670**	**69,360**	**361,710**	**3,984,370**

SOURCE:
GSGislason (2009)

Table 5 indicates that visitors from the rest of B.C. and Canada account for a higher share of angler days in the Peace region than in most other regions. This may be due in part to the region's proximity to the Alberta border. This trend is unchanged in 2010 (Go Fish BC 2012, pers. comm.).

Table 5 Regional share of B.C. freshwater angler days, 2005

Angler Residence	Share of Regional Days									
	VI	LM	TN	KO	CA	SK	OM	PE	OK	All
Own B.C. Region	90%	92%	43%	69%	32%	53%	68%	53%	76%	**66%**
Rest of B.C.	5%	4%	49%	14%	51%	28%	22%	30%	21%	**24%**
Rest of Canada	2%	1%	3%	13%	4%	11%	7%	16%	2%	**5%**
Outside Canada	3%	3%	5%	4%	13%	8%	3%	1%	1%	**5%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

NOTES:
VI – Vancouver Island
LM – Lower Mainland
TN – Thompson-Nicola
KO – Kootenay
CA – Cariboo
SK – Skeena
OM – Omineca
PE – Peace
OK - Okanagan
SOURCE:
GSGislason (2009)

2.4 Angler Expenditures

Angler expenditures in the Peace region in 2005 were predominantly for camping and boating equipment (44%), travel and vehicles (27%) and accommodation and food (17%) (Table 6). The 2005 DFO survey of sport fishing in Canada estimated per angler expenditures by B.C. anglers at $672, a nominal decline of 4% from 2000, but a 15% decline in real terms based on the B.C. Consumer Price Index (DFO 2007). In 2010, B.C. anglers spent an average of $730 each (Go Fish BC 2012, pers. comm.).

Table 6 Peace Region sport fishing expenditures, 2005

Expenditure Item	Angler Expenditures by Category $000
Trip Expenditures	
Packages and guide services	100
Accommodation and food	1,190
Travel	960
Owned boat costs	400
Licence fees	160
Fishing supplies	280
Fishing services	40
Subtotal	***3,130***
Capital Expenditures	

Expenditure Item	Angler Expenditures by Category $000
Fishing equipment	200
Boating equipment (new)	120
Boating equipment (used)	1,770
Camping equipment	1,200
Vehicles	580
Land and buildings	0
Other	80
Subtotal	***3,950***
Total Trip & Capital Expenditures	**7,080**

SOURCE:
GSGislason (2009)

Both package and guide expenditures are made almost exclusively by non-Canadians, but the location of tourism operators receiving these expenditures in the Peace region is not known. In 2008 to 2009 there were 16 angling guides and 10 assistant angling guides licensed in the Peace region (GSGislason 2009). BC Stats monitors provincial fishing lodges as part of its room revenue tracking system, but there are too few lodges in the Northeast to warrant a listing of either room inventories or revenues. The Northern B.C. Tourism Association features two freshwater fishing lodges in the Northeast, one of which is located in the RAA (Torwood Lodge in Hudson's Hope) (2012). Sport Fishing B.C. does not list any Northeast lodges on its website. Similarly, information on angling guide activity is limited. In 2012, there were 3 individuals listed as freshwater angling guides for the Peace region in BCMOE's guide directory, out of a total number of 71 freshwater angling guides for the province (BCMOE 2012b). A discussion with a former fishing guide on the Peace indicated that very little guided angling was occurring on the Peace River due to low demand. This was attributed to the absence of the higher value species (i.e., salmon, sturgeon) and the high costs of operating jet boats (Hopkins 2011, pers. comm.). A guide outfitter, based in Hudson's Hope, offers guided fishing on the Peace River.

2.5 Peace Region Angling Profile

Table 7 summarizes the 2005 freshwater angling profile of the Peace region and B.C.

Table 7 Freshwater angling profile of the Peace Region and B.C., 2005

Profile	Peace Region	B.C.	Peace Region % of Provincial Total
Activity			
Active anglers ('000)	6.1	270.8	2.3
Angler-days ('000)	69.4	3,984.4	1.7
Fishing packages purchased	30	9,230	0.3
Expenditures ($ millions)			
Packages and guides	0.1	17.0	0.6
Accommodation and food	1.2	74.9	1.6
Travel	1.0	59.6	1.7
Boat costs	0.4	19.8	2.0

Profile	Peace Region	B.C.	Peace Region % of Provincial Total
Licence fees	0.2	9.6	2.1
Supplies and services	0.3	23.8	1.3
Fishing equipment	0.2	18.4	1.1
Boats	1.9	77.8	2.4
Camping equipment	1.2	48.0	2.5
Special vehicles	0.6	55.4	1.1
Land and buildings	0	3.6	0
Other	0.1	5.8	1.7
Catch '000 Fish (kept or released)			
Rainbow trout	39.9	3,929.6	1.0
Cutthroat trout	0.8	913.6	0.1
Steelhead trout	0	135.4	0
Brook trout	3.1	148.8	2.1
Other trout	5.9	538.0	1.1
Kokanee	0	480.7	0
Salmon (non-tidal)	0.2	1,064.3	<0.1
Non-salmonids	102.0	982.1	10.4
Provincial Economic Impacts[a]			
Gross domestic product ($ millions)	3.0	210.4	1.4
Wages and benefits ($ millions)	1.7	120.2	1.4
Employment (person-years)	55	3,875	1.4
Taxes paid ($ millions)	1.8	125.1	1.4

NOTE:
[a]Impacts are total impacts (i.e., direct industry plus indirect supplier plus induced consumer spending).
% - percentage
SOURCE:
GSGislason (2009)

The growing population of the region and a consistent increase in the average number of days fished over the last 20 years would cause the regional demand for angling to increase, assuming that in-migrants and their families have similar participation rates to the existing population. Declining participation rates, the distance and associated cost to access the area by out-of-region anglers and the lack of high profile, destination fisheries are likely offsetting factors. An example of the latter is the absence of any classified waters in the Peace region. B.C. has a special classified waters system that regulates 42 highly productive trout streams. The Classified Waters Licensing System was created to preserve the unique fishing opportunities provided by these waters, which contribute to the province's reputation as a world-class fishing destination.

2.6 Site C Creel Survey Results

The LGL (2010) study identified a total of 49 recreation sites, 15 of which were noted as sites where fishing occurs (Table 8).

Table 8 Recreation sites where fishing occurs in the local assessment area

Site Name	River Stratum		
	Peace Canyon Dam to Hudson's Hope	Hudson's Hope to Site C Clean Energy Project	Site C Clean Energy Project to Alberta Border
Number of Fishing Participants (2008-09)	313	419	232
Recreation Sites and Locations			
Highway 29 Bridge	●	○	○
Alwin Holland Memorial Park	●	○	○
Hudson's Hope Boat Launch	○	●	○
Lynx Creek Boat Launch	○	●	○
Lynx Creek RV Park	○	●	○
The Gates Boat Launch	○	●	○
Unmaintained Campsite B	○	●	○
Farrell Creek	○	●	○
Peace Island Park	○	○	●
confluence of Beatton River	○	○	●
Blackfoot Park/"Clayhurst"	○	○	●
Shoreline Access D	○	○	●
Shoreline Access E	○	○	●
Pine River: East Pine	○	○	○
Pine River: Twidwell Bend	○	○	○

NOTES:
● – indicates presence of recreation site within river stratum.
○– indicates absence of recreation site within river stratum.
SOURCE:
LGL (2010)

Total angling effort estimated in the LGL (2010) study was 24,622 angler-hours (6,757 angler-days), of which 18,489 hours (5,070 angler-days) were in the Peace River mainstem, and 6,134 hours (1,687 angler-days) were in the Pine River watershed. Within the Peace River, 53% of the angling activity occurred in the river stratum from Hudson's Hope to the Site C Project site. About 20 years prior, a similar creel survey of the Peace River mainstem was conducted (which found similar levels of angler effort: a total of 17,430 angler hours between Peace Canyon Dam and Site C (DPA 1991; Table 9). The similarity of these effort estimates, despite a 20 year difference between the studies supports the conclusion that the overall demand for recreation and tourism is not increasing and may be decreasing, despite increases in the Peace River Regional District population (6% between 2001 and 2006 and 3% between 2006 and 2011; Statistics Canada 2007; 2012).

At the same time, the LGL study and DPA's results contrast strongly with those of another survey from the 1980s (Hammond 1986; Table 9). Hammond estimated total angling effort for a limited part of the LGL study area (from the Peace Canyon Dam to Farrell Creek) over a five-month period to be 16,898 angler-hours: a value similar to what was stated in the LGL study for the entire Peace River over the entire year (1986). Given that angler effort varied widely between 2008 and 2009, it is possible that some of the differences among studies resulted from year-to-year variability in angling effort

levels. LGL's confidence limits were large and Hammond's calculation methods are not described, thus the reasons for the differences between reports cannot be determined. Nevertheless, the disagreement between the Hammond (1986) and DPA (1991) results may call into question the validity of any comparisons of LGL (2010) angler effort estimates to those from the late 1980s.

The results of the LGL creel survey and other creel surveys do have inherent limitations associated with natural variability in the population (e.g., catch rates) and sampling error. With respect to natural variability, most catches are of zero fish and the larger the catch the rarer the event. Given the wide range of possible outcomes for a fishing event it is difficult to predict with confidence how many fish an angler is going to catch. This difficulty translates into wide confidence limits around any estimate of total catch.

In terms of sampling error, with any sampling program, the confidence in final estimates is greater when a larger proportion of the population has been sampled. In the LGL study, the number of interviews per month ranges from 13 to 86 or 0.8 to 5.3 interviews for each of the 16 sampling categories (i.e., day type, access method, and river stratum). With catch success expected to be variable, the confidence in estimates for a sample of less than 5 is low. To address this uncertainty, LGL pooled data among categories from 2008 and 2009. To simulate increased interviewing, all data was copied twice which reduced the standard error from 83% down to 51% (still a relatively large standard error). Furthermore, the accuracy of creel results is only as good as the data provided by anglers to the interviewers. Inspection of harvested fish was rarely permitted and without verification of catch, confidence in the accuracy of data provided by anglers is lowered. Limited sample sizes and wide confidence limits mean that creel results must be interpreted with caution.

Table 9 compares fishing levels on the Peace River from historical creel surveys to the most recent data available (i.e., LGL 2010). Whitefish and rainbow trout were the most commonly caught fish across all of the studies. Walleye or perch were more common downstream of the Site C dam site.

The 2008-2009 catch (fish harvested and released) estimates showed that Arctic grayling (2,446 fish) and mountain whitefish (2,443 fish) were the species that were caught in greatest numbers, the majority of which were caught in the Pine River (LGL 2010). The total catch of rainbow trout and bull trout, summed across all strata was estimated at 1,883 fish and 1,569 fish, respectively. Annual catch estimates for the Peace River mainstem indicated that rainbow trout was caught most frequently (1,786 fish), followed by bull trout (983 fish) and mountain whitefish (978 fish). For certain species (e.g., rainbow trout), the distribution of catch across river strata was strongly skewed with larger numbers of fish caught in areas upstream of the Project.

Total harvest (retained fish) was dominated by Arctic grayling (284 fish), rainbow trout (224 fish) and mountain whitefish (182 fish) (LGL 2010). Retention rates were highest for lake trout and northern pike, with 27% and 14% of catch retained, respectively. Despite being a catch and release fishery, bull trout were retained 5% of the time.

Table 9 Peace River fishing survey results

Year	Area	Season	Angler hours	Angler days	Hours per Angler days	Effort per River km	Total Catch	Catch per Hour	Catch by Species	Reference
1985	Peace Canyon Dam to Farrell Creek (14 km)	June 1985 to October 1985	16,898	NA	NA	1,207 hrs/km	7,667	0.45/hr	RB: 4,469 (58%) **WF: 2,890 (38%)** GR: 164 (2%) BT: 144 (2%)	Hammond 1986
1989/90	Peace Canyon Dam to Farrell Creek (14 km)	May 1989 to April 1990	9,970	4,420	2.26	712 hrs/km 315 days/km	5,073	0.51/hr 1.15/day	RB: 2,005 (40%) **WF: 2,400 (47%** GR: 389 (8%) BT: 149 (3%) KO: 101 (2%) NP: 29 (0.6%)	DPA 1991
1989/90	Peace Canyon Dam to Site C (83 km)	May 1989 to April 1990	17,430	7,550	2.31	210 hrs/km 91 days/km	9,432	0.54/hr 1.25/day	RB: 2,445 (26%) **WF: 4,747 (50%)** GR: 1,399 (15%) BT: 304 (3%) KO: 129 (1%) NP: 359 (4%) WP: 49 (1%)	DPA 1991
2008/09	Peace Canyon Dam to Hudson's Hope (7km)	April 2008 to March 2009	3,032	833	3.64[a]	433 hrs/km 119 days/km	864	0.28/hr 1.04/day	**RB: 602 (70%)** WF: 71 (8%) GR: 18 (2%) BT: 143 (17%) NP: 8 (1%) WP: 9 (1%) GE: 13 (2%)	LGL 2010

Year	Area	Season	Angler hours	Angler days	Hours per Angler days	Effort per River km	Total Catch	Catch per Hour	Catch by Species	Reference
2008/09	Peace Canyon Dam to Site C (83 km)	April 2008 to March 2009	12,875	3,537	3.64[a]	155 hrs/km 43 days/km	3,418	0.27/hr 0.97/day	**RB: 1,692 (50%)** WF: 515 (15%) GR: 300 (9%) BT: 635 (19%) NP: 102 (3%) WP: 70 (2%) GE: 104 (3%)	LGL 2010
2008/09	Site C to Alberta Border (49 km)	April 2008 to March 2008	5,613	1,542	3.64[a]	114 hrs/km 31 days/km	1,439	0.26/hr 0.94/day	RB: 70 (5%) WF: 120 (8%) GR: 94 (7%) BT: 259 (18%) NP: 236 (16%) **WP: 550 (38%)** GE: 110 (8%)	LGL 2010

NOTES:
aPooled study average (not corrected for river stratum).
% – percentage
hr – hour
hrs – hours
km – kilometre
NA – data not available
BT – bull trout
GE – goldeye
GR – Arctic grayling
KO – kokanee
NP – northern pike
RB – rainbow trout
WF – whitefish
WP – walleye/pickerel
SOURCES:
DPA (1991); Hammond (1986); LGL (2010)

3 HUNTING

3.1 Hunting and Season Limits

The provincial government manages game species and maintains hunting opportunities through a variety of management tools, including hunting seasons, licensing, regulations of various types and permits designed to retain the sustainability and health of the resource. As shown in Table 10, for most species, the hunting season runs from late August to late November, with the greatest overlap in the late October and early November periods. Bag limits are one for all ungulates and cougar, two for black bear, and three for wolf. There is no bag limit for coyote. Bag limits for birds range from nine for Sharp-tailed Grouse to 30 for Spruce and Ruffed Grouse.

Table 10 Local assessment area species bag limits and seasons, 2012-2014

Species	Class	Management Unit	Season	Bag Limit
Mule deer	3 point bucks	7-31 to 7-35	Nov 1 – Nov 30	1
	antlerless	7-20 Zone A	Nov 15 – Nov 30	1
	either sex	7-32 to 7-35	Sept 1 – Sept 30 (bow only season)	1
White-tailed deer	bucks	7-31 to 7-35	Sept 10 – Nov 30	1
			Sept 1 – Sept 9 (bow only/youth only season[a])	1
	antlerless	7-20 Zone A	Oct 10 – Oct 31	1
	either sex	7-20 Zone A	Nov 1 – Nov 30 (youth only season)	1
Moose	bulls	7-31 to 7-35	Aug 15 – Aug 31	1
	spike-fork bulls, tripalm bulls, 10 point bulls	7-31	Sept 1 – Oct 31	1
		7-32 to 7-35	Sept 1 – Sept 30, Oct 16 – Oct 31, Oct 1 – Oct 15 (bow only season)	1
Elk	6 point bulls	7-31	Sept 1 – Oct 31	1
	3 point bulls	7-20 Zone A		
	antlerless	7-20 Zone A	Sept 15 – Oct 31	1
Black bear	N/A	7-31 to 7-35	Aug 15 – Nov 15, Apr 1 – June 15	2, 2
Cougar	N/A	7-31 to 7-35	Sept 10 – Mar 31	1
Wolf	N/A	7-31 to 7-35	Aug 1 – Mar 31, Apr 1 – June 15[b]	3, 3
Coyote	N/A	7-31 to 7-35	Sept 1 – Mar 31[b]	None
Wolverine	N/A	7-31 to 7-35	Oct 15 – Jan 15	1
Lynx	N/A	7-31 to 7-35	Nov 15 – Feb 15	1
Snowshoe hare	N/A	7-31 to 7-35	Aug 1 – Apr 30	10 (daily)
Dusky (blue) Grouse	N/A	7-31	Sept 1 – Nov 15	10 (30)[c]
Spruce and Ruffed Grouse	N/A	7-31 to 7-35	Sept 1 – Nov 15	10 (30)
Sharp-tailed Grouse	N/A	7-32 to 7-35	Sept 1 – Nov 15	3 (9)
Ptarmigan	N/A	7-31	Aug 15 – Feb 28	10 (30)

Species	Class	Management Unit	Season	Bag Limit
Raven	N/A	7-32 to 7-35[d]	No closed season	5
Coots, Common Snipe	N/A	7-31 to 7-35	Sept 3 – Nov 30	10 (20)
Ducks	N/A	7-31 to 7-35	Sept 3 – Nov 30	8 (16)
Geese: Snow, White-fronted, Ross's, Canada & Cackling	N/A	7-31 to 7-35	Sept 3 – Nov 30	5 (10)

NOTES:

MU 7-20 Zone A fully encompasses MUs 7-32, 7-33, and 7-34, as well as portions of 7-35

[a] Restricted to hunters under the age of 18

[b] No closed season below 1100 m elevation

[c] Daily limit (total limit)

[d] Restricted to private land (with permission of the landowner)

N/A – not applicable

SOURCE: BCMOE (2012c)

Limited Entry Hunting (LEH) is another management tool which allocates hunting opportunities by lottery. The purpose of LEH is to achieve wildlife management objectives without resorting to such measures as shortening seasons or closing areas. LEH seasons are introduced where necessary to limit the number of hunters, the number of animals that may be taken or the harvest to a certain class of animal. Elk (antlerless or unrestricted) and moose (calf only) LEH draws are available in the RAA and LAA. The elk LEH season is open from December 1 to February 28. The moose LEH season is August 15 to August 30 and October 16 to October 31. Although general open seasons may coincide for all species, the class of animal available will often be different. Table 11 and Table 12 show elk and moose LEH harvest statistics for the most recent years available in the LAA.

There are several no-hunting and restricted hunting zones in the LAA, including within 100 m of the Peace River for game birds, around Charlie Lake, west of Farrell Creek (firearms using shot only in specified area of MU 7-35), and on the Upper Halfway River (caribou closed area in MU 7-57). Almost all of the LAA, except a small zone along the Upper Halfway River, has been designated for an Agricultural Zone Hunt in 2008/2009 for elk, white-tailed deer and mule deer. This hunt was established following a structured decision-making process in the region led by the BCMOE and including various stakeholders, including local hunting clubs, guide outfitters and ranchers.

Table 11 Elk limited entry hunting harvest statistics in the local assessment area

Year	Management Unit	Animal Class	Permits Available	First Choice Applicants	Hunting Survey Respondents	Estimated Hunters	Success Rate [%]	Estimated Kills	Estimated Days Hunting	Days per Kill
Elk										
2008	7-20 Zone A	antlerless	1,240	4,056	561	552.6	48.8	269.7	2,542	9.4
		any sex/age	800	3,144	354	404.5	45.2	182.9	1,848	10.1
2009		antlerless	1,240	4,500	609	635.3	44.2	281.0	3,026	10.8
		any sex/age	800	3,450	433	423.2	48.5	205.1	1,850	9.0
2010		antlerless	1,240	5,966	531	464.7	48.2	224.2	2,162	9.6
		any sex/age	800	3,946	332	343.1	46.6	160.0	1,468	9.2
% change antlerless			0.0	47.0	-5.3	-15.9	-1.2	-16.9	-14.9	2.1
% change any sex/age			0.0	25.5	-6.2	-15.2	3.1	-12.5	-20.6	-8.9
Total antlerless			**3,720**	**14,522**	**1,701**	**1,652.6**	**46.9**	**775.0**	**7,730**	**10.0**
Total any sex/age			**2,400**	**10,540**	**1,119**	**1,170.8**	**46.8**	**548**	**5,166**	**9.4**

NOTES:
% - percent

SOURCE:
BCMFLNRO, Environmental Assessment Coordinator (2012, pers. comm.)

Table 12 Moose limited entry hunting harvest statistics in the local assessment area

Year	Management Unit	Animal Class	Permits Available	First Choice Applicants	Respondents	Estimated Hunters	Success Rate [%]	Estimated Kills	Estimated Days Hunting	Days per Kill
Moose										
2000	7-32, 7-33, and 7-34	calf only	137	161	90	76.1	15.1	11.5	289	25.1
2001			165	141	92	84.2	15.0	12.6	318	25.2
2002			165	179	99	78.7	38.2	30.1	317	10.5
2003			165	162	102	86.0	29.9	25.7	377	14.7
2004			165	137	85	76.5	30.1	23.0	400	17.4
2005			180	105	68	68.5	47.0	32.2	463	14.4
2006			240	135	71	94.6	45.2	42.8	457	10.7
2007			240	142	74	85.0	22.2	18.9	444	23.5
2008			240	130	62	74.4	17.7	13.2	510	38.6
2009			240	142	80	86.4	29.7	25.7	483	18.8
2010			240	163	73	70.0	32.9	23.0	626	27.2
% change			75.2	1.2	-18.9	-8.0	117.9	100.0	116.6	8.4
Total			**2,177**	**1,597**	**896**	**880.4**	**29.4**	**258.7**	**4,684**	**18.1**

NOTES:
% - percent

SOURCE:
BCMFLNRO, Environmental Assessment Coordinator (2012 pers. comm.)

The inception of the hunt, along with more liberalized regulations such as a longer season and increased bag limits, has increased hunting opportunities in the RAA over the last three years (BCMOE, Wildlife Biologist 2009b pers. comm.).

Hunters who participated in the focus group interviews in 2011 expressed concern that the hunting seasons and limits for ungulates do not consider that harsh winters in recent years have reduced deer and moose numbers in the region considerably. Members of the rod and gun clubs will often participate in meetings with the BCMOE to discuss these issues and provide input into revised regulations. The elk LEH has not been in place long enough to determine a longer term trend but estimated harvests, along with other hunting activity indicators, did decline between 2008 and 2010. The moose calf LEH data indicate that in the eleven years the hunt has been available, interested hunters are steadily spending more days hunting and have been more successful. The most recent numbers of kills have declined since mid-2000 but are higher overall than in the early 2000. Days per kill were also lower and success rates were higher in mid-2000.

3.2 Hunting Licence Sales

Hunting licence sales for the Peace Region and the province of B.C. are shown in Table 13. The number of licences sold in the RAA was up 2% between 2000 and 2007, compared to the decline in provincial hunting licence sales of 6%. The low point in yearly sales for the RAA was 2003 and 2004 for the province. While licence sales are believed broadly indicative of hunting activity, they do not indicate where the licensee actually hunted. The fact that hunting licence sales are generally on the increase in the Peace Region when they are declining in the rest of the province indicates a higher interest in hunting in the RAA.

3.3 Hunting Activity

Harvest data by species, for the management units in the RAA and LAA, and for the 11-year period ending in 2010 are shown in Table 14.

Hunting activity data for the management units in the RAA and LAA for the 10-year period between 1996 and 2005 is shown in Table 15.

The demand for B.C. resident hunting in the RAA is primarily a function of local population size and the propensity of use by hunters from B.C. who are not resident in the RAA. In turn, participation rates are influenced by costs, demographic variables (e.g., age, gender, ethnicity) and convenience (in terms of regulatory and licensing requirements).

Table 13 Hunting licence sales in the Peace Region and British Columbia, 2000-2009

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	% Change 2000-2007
Peace Region[a]											
Licences Sold	8,524	7,697	7,995	7,955	7,685	8,198	8,543	8,659	NA	NA	2%
Fee Revenue	$219,577	$199,630	$205,583	$264,096	$249,945	$263,042	$280,029	$272,519	NA	NA	24%
British Columbia											
Licences Sold – resident[a]	93,740	86,580	85,714	81,736	84,003	85,633	87,170	87,722	90,867	92,235	-6%
licences sold – non-resident[b]	5,887	5,612	5,752	5,785	5,931	6,387	6,244	5,891	5,620	5,112	<1%
fee revenue [$000][a]	$2,165	$1,996	$2,022	$2,659	$2,797	$2,784	$2,862	$2,844	NA	NA	31%

NOTE:

NA – data not available

SOURCES:

[a]BCMOE (2009); [b]BCMFLNRO, Environmental Assessment Coordinator (2011a, pers. comm.)

Table 14 Big game species harvested in management units in the RAA and LAA, 1999-2010

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2010	% Change
Local Assessment Area												
Black bear	63	129	79	101	55	68	75	58	102	63	83	**32%**
Caribou	—	—	—	—	—	—	—	—	—	—	—	**N/A**
Cougar	—	—	—	—	—	—	—	—	—	—	0	**N/A**
Elk	99	122	172	170	246	243	376	387	375	746	652	**559%**
Goat	—	—	—	—	—	—	—	—	—	—	—	**N/A**
Grizzly	—	1	—	—	—	—	—	—	3	1	0	**N/A**
Moose	452	570	782	885	1,009	542	897	936	310	267	552	**22%**
Mule deer	634	935	782	773	773	715	893	1,234	1,254	1,108	635	**<1%**
Sheep	—	—	—	—	1	—	—	—	—	—	—	**N/A**
White-tailed deer	258	406	110	300	318	277	423	342	438	524	731	**183%**
Wolf	23	57	—	29	27	17	16	10	40	23	48	**109%**
Total	**1,529**	**2,220**	**1,925**	**2,258**	**2,429**	**1,862**	**2,680**	**2,967**	**2,522**	**2,732**	**2,701**	**77%**
Regional Assessment Area												
Black bear	331	356	256	249	269	189	274	246	269	210	202	**-39%**
Caribou	46	40	44	30	24	16	30	32	14	18	—	**-61%**
Cougar	—	—	—	—	—	1	—	—	—	1	0	**N/A**
Elk	270	422	535	478	585	513	823	1,004	929	1,534	1,493	**453%**
Goat	96	85	64	63	65	53	71	62	53	60	6	**-93%**
Grizzly	37	28	13	38	36	37	44	26	54	48	10	**-74%**
Moose	1,536	1,480	1,959	2,177	2,300	1,327	2,182	2,201	1,278	1,236	1,229	**-20%**
Mule deer	1,931	1,127	970	889	952	871	1,079	1,553	1,658	1,426	809	**-58%**
Sheep	62	52	47	43	34	23	34	34	28	36	3	**-95%**
White-tailed deer	425	677	203	486	529	572	784	698	871	1,076	1,415	**233%**
Wolf	75	228	65	104	124	67	128	91	206	217	240	**220%**
Total	**4,809**	**4,495**	**4,156**	**4,557**	**4,918**	**3,669**	**5,449**	**5,947**	**5,360**	**5,862**	**5,407**	**12%**

NOTES:

N/A – not applicable

— not collected

SOURCES:

LAA Harvests 1999-2005 – BCMOE (2008); LAA Harvests 2006-2008 and RAA Harvest 1999-2008 – BCMFLNRO, Environmental Assessment Coordinator (2011c, pers. comm.); BCMFLNRO, Environmental Assessment Coordinator (2012, pers. comm.)

Table 15 Hunting activity in management units in the local assessment areas, 1996-2008

Hunting Activity	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	% Change
Resident Hunters														
Number of hunters	5,797	5,907	7,089	6,514	6,411	5,329	6,204	5,991	4,905	6,454	6,766	7,301	7,704	**33%**
Hunter days	34,357	34,332	41,409	42,028	41,393	36,704	37,322	32,899	27,611	38,627	37,552	48,011	49,215	**43%**
Harvest	1,574	1,849	2,216	1,504	2,172	1,882	2,227	2,398	1,825	2,632	2,924	2,492	2,691	**71%**
Expenditure [$ millions]	$1.6	$1.6	$1.9	$2.0	$2.0	$1.9	$2.0	$1.7	$1.5	$2.2	NA	NA	NA	**38%**
Consumer surplus [$ millions]	$1.6	$1.7	$2.0	$2.1	$2.1	$1.9	$2.0	$1.8	$1.6	$2.2	NA	NA	NA	**37%**
Non-Resident Hunters														
Number of hunters	97	80	77	72	114	167	107	115	103	147	110	95	109	**12%**
Hunter days	686	492	452	435	785	1,234	796	710	525	809	567	395	124	**-82%**
Harvest	48	36	38	25	48	43	31	31	37	48	43	30	41	**-15%**
Expenditure [$ millions]	$0.2	$0.2	$0.2	$0.2	$0.3	$0.5	$0.3	$0.3	$0.2	$0.4	NA	NA	NA	**43%**
Consumer surplus [$ millions]	$0.04	$0.03	$0.03	$0.03	$0.05	$0.1	$0.06	$0.05	$0.04	$0.07	NA	NA	NA	**52%**

NOTES:

NA – data not available

Due to rounding, percentage changes may not equal the percentage change of the dollar values presented in the table.

SOURCE:

BCMOE (2008)

With Northeast B.C. representing close to one quarter of the province's land area, large tracts of wilderness support a diverse range of big game. In the Peace River valley, wildlife is abundant and hunting areas on Crown and private land readily accessible. While the Project footprint represents only 0.5% of the LAA area of approximately two million hectares, interviews have suggested that resident hunters placed a higher value on hunting on and along the Peace River compared to most other areas of the LAA (Koslowski 2008, pers. comm.; Hudson's Hope Rod and Gun Club, Members 2011, pers. comm.; North Peace Rod and Gun Club, Members 2011, pers. comm.). This is because some aspects of the Peace River experience such as hunting on the islands is relatively rare in the regional context.

Trends in regional hunting demand appear to be diverging from provincial trends, at least in the short and medium terms. There has been a province-wide decline in hunting licences issued and hunting activity over the last 30 years, but this trend is not evident in the Peace River region, where the number of resident hunters grew by 11% during the 10-year period ending in 2005. A greater number of hunters from southern B.C. may also be coming to the region as hunting areas shrink due to the encroachment of urban development and the expansion of protected areas. Population growth during this same period was in the range of 18%, which would imply a declining participation rate, everything else being the same, though not as much of a decline as seen in the province as a whole. However, with the creation of the Agriculture Zone Hunt, local hunting opportunities have increased in the last three to four years, and the number of hunters has apparently increased. This trend is not captured in Table 15 (BCMOE, Wildlife Biologist 2009b pers. comm.).

The recreational aspect of hunting remains an important lifestyle element for hunters, in addition to contributing to the local economy. The total number of members in the four nearby rod and gun clubs is estimated to be more than 1,000, and about 80% of members are active hunters from year to year.

The North Peace Rod and Gun Club, based in Fort St. John, has a current membership of over 600 (youth, adults and families), while the Hudson's Hope Rod and Gun Club has about 50 single and family memberships. The Peace River is valued by members of local rod and gun clubs for its hunting areas, notably the islands and the north shore slopes with a south-facing aspect where wildlife is more abundant, and (in the case of the islands) where less hunter effort is needed. The lower river bottom is winter range for major species, namely elk, deer and moose. Much of the hunting on the north shore is on private land. The south shore and north-facing aspects are not used as much and receive an estimated 20% of total hunter effort on the river, compared to 80% for the islands and north shore (Holland 2009, pers. comm.). Hunters use river boats along the Peace, Pine and Halfway rivers and some members belong to the Peace Country River Rats. Most group members hunt north of the river and as far north as the Muskwa-Kechika area (North Peace Rod and Gun Club, Members 2011, pers. comm.). Hunters from Hudson's Hope frequent the Bear Flat area, the Gates and up the Halfway River. Farrell Creek also provides access for hunting (Hudson's Hope Rod and Gun Club, Members 2011, pers. comm.).

Accessibility is a factor in the distribution of hunting pressure on the river. The islands and the south shore are accessed by river boats launched from Peace Island Park, Halfway River and Lynx Creek. It is also possible to put a boat in at Farrell Creek, but it is not a recognized launch. Approximately half of the hunters launching from Peace

Island Park would be heading west to river islands upstream from the Site C dam site, while the other half would be going down stream. Hunters launching at the Halfway River would be heading both upstream and downstream on the Peace, while some would also be going up the Halfway itself (Holland 2009, pers. comm.).

Road access to the south shore is possible in places, mainly via Jackfish Lake Road, but for Fort St. John hunters the travel times are close to three hours. Access to the north shore between Bear Flat and Hudson's Hope via Highway 29 is convenient and low-cost.

While hunters interviewed generally agreed that the Peace region offers numerous hunting opportunities, they indicated that hunting pressure is increasing with the population. Hunters were concerned about the effects of recent harsh winters on the ungulate populations and some participants wondered if hunting seasons could be shortened.

Hunters from Chetwynd use the river corridor, though less frequently than hunters from Hudson's Hope and Fort St. John. The Chetwynd and District Rod and Gun Club have 153 memberships. Members are more likely to hunt in the Del Rio and Stewart Lake area than the Peace River corridor because they are much closer and opportunities remain good (Eastman 2009, pers. comm.). The Del Rio is a very heavily used hunting area as oil and gas activity has provided access (Chetwynd and District Rod and Gun Club, Members 2011, pers. comm.).

Roughly half of the 1,200 members of the Dawson Creek Sportsman's Club regularly use the Peace River and its major tributaries for hunting due to its proximity to the community and ease of access via the Peace Island Park boat launch (Mathias 2009, pers. comm.; Mayor 2011, pers. comm.). Areas north of Chetwynd, Stewart Lake and especially the Del Rio area are also heavily used by members of the Dawson Creek club.

Private land or agricultural land hunting occurs on Bear Flat and up the Halfway River. During April to May 2011, BC Hydro mailed questionnaires to property owners that own or lease land within areas potentially affected by the Project. Thirty-seven property owners responded to the questionnaire. Nine of those owners (24%), indicated that they allow hunting on their property. Seven of these nine owners indicated that they allowed hunting for deer, six allowed hunting for elk, three allowed hunting for moose, three allowed hunting for black bear, and one owner allowed hunting for Nabor's buffalo on their property. Therefore, while hunting does occur on potentially affected private land, it is not as common or likely as hunting on public lands in the LAA.

3.4 Trapping

Registered trapping activity is administered by the BCMOE. The registered trapline system is the primary system for setting harvest guidelines and managing furbearing animals. In 1926, the province was divided into registered traplines, giving the trapline owner the exclusive right to trap furbearing animals inside the trapline area. Traplines typically cover a large land area. The Fish and Wildlife Branch of the BCMOE in Fort St. John manages approximately 250 traplines including those in the LAA. There are a total of 16 traplines in the LAA.

The trapping season is based on a variety of criteria including pelt primeness, relative vulnerability of age and sex classes to harvesting, abundance, and capture technology.

In the Peace region, trapping activity is concentrated between October and late February for most species. The trapping of beaver may occur up to early May in some years.

Key habitat for trapping includes mature or old growth forest for marten and wetlands and riparian areas for beaver and muskrat. Willow swamps were identified as key habitat for coyote, wolf, lynx, and marten. Trapping occurs along the breaks and lower benches north of the river. One trapper noted that the distribution of animals throughout a trapline is affected by plant growth and weather so trapping areas are modified to suit expected locations of animals (Trapper Interviews 2012, pers. comm.).

In the LAA, traps are set on the flats along the Peace River, and some trappers may set traps in the river, but the location and number of traps is not documented. Existing roads, trails, and cutlines are used throughout traplines. Many use a variety of access methods including going on foot or snowshoe, riding horses, skidoos and all-terrain vehicles and trucks depending on the level of access and the desire to create or maintain new access to areas within the trapline. Boats are also used on the Peace River to reach trapping areas along the Peace and Moberly rivers. Local roads such as the Medicine Woman Road, Jackfish Lake Road, and the Del Rio Road are used by trappers south of the river. Trappers access the Project activity zone regularly during the trapping season and noted the importance of these trails or roads for their traplines. Trappers described or mapped trapping locations, access and cabins within and in the vicinity of the Project activity zone during interviews with BC Hydro.Trappers also listed which species they trap within the proposed Project area (Figure 1). Marten, beaver and fisher were the most commonly trapped species in the Project activity zone.

Aboriginal people are involved in the use of half of the affected traplines, either as the registered owners or through agreements with the registered trapline owner.

Table 16 Trapping harvests in the local assessment area, 2001-2008

Species Harvested	Total Harvest	Average Annual Harvest
Beaver	255	32
Black bear	2	<1
Coyote	90	11
Fisher	37	5
Fox	12	2
Lynx	31	4
Marten	1,684	211
Mink	25	3
Muskrat	73	9
Otter	1	<1
Squirrel	4,072	509
Weasel	334	42
Wolf	7	1
Wolverine	5	1
Total	**6,628**	**829**

NOTES:
Totals may not add up due to rounding.
SOURCE:
BCMFLNRO, Environmental Assessment Coordinator (2011b, pers. comm.)

Table 16 summarizes the harvest from the traplines overlapping the LAA for eight years from 2001-2008. Marten accounts for a large proportion of the animals trapped and an associated a large proportion of the total revenue from trapping. Collectively marten, lynx, beaver, and fisher made up an average of 60% of the annual trapping revenue between 2005 and 2008 (Table 17). Trapping is typically pursued as a lifestyle activity, and less often as a primary income source.

Table 17 Trapping values for traplines in the local assessment area, 2005-2008

Animals Harvested	Average Annual Harvest	Average Price per Animal ($)	Price Range ($)	Average Annual Revenue ($)	Average Royalty per Animal ($)	Average Annual Royalty per Animal ($)
Beaver	47	26.68	22.47 – 28.27	1,253.96	0.77	36.19
Coyote	29	33.30	24.47 – 42.16	965.70	1.13	32.77
Fisher	13	87.10	70.68 – 94.33	1,132.30	1.99	25.87
Fox	3	25.87	21.33 – 31.66	77.61	0.85	2.55
Lynx	26	170.79	138.41 – 203.28	4,440.54	5.14	133.64
Marten	459	71.01	57.88 – 80.31	32,593.59	1.88	862.92
Mink	9	17.98	14.96 – 21.33	161.82	0.56	5.04
Muskrat	8	3.99	2.62 – 6.73	31.92	0.10	0.80
Otter	2	71.56	39.70 – 152.78	143.12	3.94	7.88
Squirrel	323	1.38	1.22 – 1.46	445.74	0.04	12.92
Weasel	79	7.50	5.31 – 9.30	592.50	0.19	15.01
Wolf	2	98.60	75.39 – 129.57	197.20	2.60	5.2
Wolverine	1	230.61	169.04 – 297.48	230.61	6.00	6.0
Total (all animals)	**1,001**	**65.11**	**2.62 – 297.48**	**65,175.11**	**1.94**	**1,941.94**

SOURCE:
BCMFLNRO, Environmental Assessment Coordinator (2011b, pers. comm.)

The trapping of furbearing animals pre-dates European settlement in the region and has been practiced continuously up to the present. However, the economic value of the activity has diminished greatly, and it is considered mainly a subsistence and lifestyle activity.

The value of harvests, while cyclic, has generally been trending up. Variation between years in the LAA is driven by the harvest and prices paid for marten, which between 2001and 2008 has accounted for 78% of the total pelt revenue.

Traplines are a form of non-exclusive use tenure on Crown land and may be sold by the registered holder. The price of a trapline depends on its particular circumstances (e.g., abundance of valuable furbearers) and improvements (e.g., a cabin). Recent prices for an average trapline is in the order of $15,000- $25,000 (BCMOE, Wildlife Biologist 2009c pers. comm.). The price of some traplines south of the LAA have sold for higher prices, but the primary purpose for these areas may be for recreational purpose, since a trapline license allows one to construct a cabin on Crown land. In these cases owners may only

register the minimum harvest required to maintain active status, as opposed to actively trapping for fur.

A trapline does not preclude other uses on the land. For instance, timber harvesting commonly occurs in trapline areas. In the case of oil and gas activities, the industry has established a referral and compensation policy to address those cases where traps need to be moved. Although there is no provincial policy requirement for this arrangement, the BCMOE and the Ministry of Energy, Mines, and Petroleum Resources have developed a framework in cooperation with industry.

3.5 Guide Outfitting

The guide outfitter industry in B.C. contributes to economic activity in all regions of the province, including the northeast, and plays an important role in attracting tourists to B.C. In 2002, 223 guide outfitters offered hunts in B.C., guiding 5,144 clients and generating $64.4M in total revenues. Over 2,000 jobs were generated. When all spinoff and secondary impacts are counted, the sector was responsible for $135M in spending, $79M in provincial GDP, 1,631 person-years of employment and more than $22M in government revenues (Pacific Analytics 2003).

In 2012, there were 48 guide outfitters with active tenures in Region 7 (Northeast B.C.) (GOABC 2012a; GOABC 2012b). There are four guide outfitters with hunting territories overlapping the LAA. There are four guide outfitters with hunting territories overlapping the LAA. One guide outfitter identified up to three cabins within the LAA that may be affected by inundation (Guide Outfitter Interviews 2012, pers. comm.). Two cabins located near the Peace River downstream of the Site C dam site are not within the inundation area. One guide outfitter has licence of occupation for a hunting camp within the footprint of the Site C dam site.

One outfitter indicated that 40-50% of his hunts occur adjacent to the Peace River in November, and during the spring and fall bear hunts (Guide Outfitter Interviews 2012, pers. comm.). He offers charter fishing, boat operation, camping and day use on islands on the Peace River. Another outfitter indicated that the Peace River valley is a good area for hunting as far up as Maurice Creek across from Hudson's Hope and that he provides hunts on horseback in areas with limited access between Hudson's Hope and Taylor (Guide Outfitter Interviews 2012, pers. comm.). Another outfitter's spring bear hunt occurs in the area of Bullhead and Portage Mountain (Guide Outfitter Interviews 2012, pers. comm.).

Outfitters commented that traffic detours or access restrictions that result from construction or industrial activities in the region adversely affect guided outfitting hunting experience for clientele and in turn can affect outfitters' operations and/or revenue (Guide Outfitter Interviews 2012, pers. comm.). In general, the outfitters are concerned with increased competition for resources (e.g., through increased access in the LAA and RAA) and diminished wilderness experience (e.g., due to visible industrial activities or the need for or exposure to motorized access) (Guide Outfitter Interviews 2012, pers. comm.). Some outfitters indicate that oil and gas industry and forestry have already disturbed their guiding areas to the point where few untouched hunting areas remain (Guide Outfitter Interviews 2012, pers. comm.).

Table 18 shows outfitter quotas and harvests in the LAA.

Table 18 Business profile of guide outfitters in the local assessment area

Guide Outfitter Tenure #	Location	Management Unit	Hunts Offered
700551	Hudson's Hope	7-35, 7-43	BB, CO, DE, EL, GB, LY, MO, WO, FW, PS, TR, WV, XC
701241	Charlie Lake	7-31, 7-35, 7-36	BB, DE, GB, MO, WOF, SS
701222	Chetwynd	7-31	BB, CO, DE, EL, GB, GO, LY, MO, WOF, WOV, PS, WV
701245	Chetwynd	7-21, 7-22, 7-32	BB, CO, DE, EL, GB, GO, LY, MO, WOF, TR, PS, WV

NOTES:
BB-black bear, CO-cougar, DE-deer, EL-elk, GB-grizzly bear, GO-goat, LY-lynx, MO-moose, SS-stone sheep, WOF-wolf, WOV-wolverine, FW-fresh water angling, PS-photo safaris, TR-trail rides, WV-wildlife viewing, XC-cross country skiing

SOURCE:
GOABC (2012c)

These outfitters offer a variety of species and hunts, but moose and deer account for the bulk of hunter effort, harvest and expenditures (Table 19). For outfitters in the LAA, about half of their clients are American, with the remainder coming from Europe, New Zealand, Australia and other parts of Canada outside of B.C. At least one of the outfitters has been affected by the downturn in the US economy, experiencing almost a 50% drop in clientele over the last five years (Guide Outfitter Interviews 2012, pers. comm.). Province-wide, the geographic origin of guide outfitters' clients is 85% American, 4% German, 6% other European and 5% other nationalities (Pacific Analytics 2003). This profile is believed to be representative of guide outfitters in the LAA. Elk, deer, moose and bear hunts are the most popular in the region. In terms of Aboriginal employment, three elders from the West Moberly First Nation work for Tracks B.C./High Prairie Outfitters as guides (Guide Outfitter Interviews 2012, pers. comm.)

Table 19 Quotas (2007-2011) and harvests (2006-2010) for guide outfitters in the local assessment area

Tenure #	700551		701241		701222		701245	
Species	**Quota**	**Harvest**	**Quota**	**Harvest**	**Quota**	**Harvest**	**Quota**	**Harvest**
Black bear	N/A	36	N/A	15	N/A	39	N/A	12
Cougar	0	0	N/A	1	0	0	0	0
Elk (antlerless)	15	44[b]	6	10[b]	0	3[b]	37	43[b]
Any elk	8[a]		4[a]		0[a]		24[a]	
Grizzly bear	5	2[a]	5	0	15	2	11	7
Lynx	0	0	0	0	N/A	1	0	0
Moose (bull)	N/A	14	N/A	3	N/A	22	N/A	17
Mountain goat	0	0	0	0	5	1	12	7
Mule deer	N/A	38	N/A	18	N/A	2	N/A	8
Stone sheep	4	1	0	0	0	0	0	0

Tenure #	700551		701241		701222		701245	
Species	**Quota**	**Harvest**	**Quota**	**Harvest**	**Quota**	**Harvest**	**Quota**	**Harvest**
Whitetail deer	N/A	31	N/A	27	N/A	18	N/A	80
Wolf	N/A	0	N/A	0	N/A	2	N/A	2
Total	**32**	**165**	**15**	**71**	**20**	**90**	**84**	**176**

NOTES:
[a]2008-2011
[b]including bulls not on quota
N/A – not applicable
SOURCE:
BCMFLNRO, Environmental Assessment Coordinator (2011b pers. comm.)

In 2002, Region 7 guide outfitters generated $23M in spending (36% of the provincial total), $14.6M in provincial GDP and over 300 person-years of employment (Pacific Analytics 2003).

4 REFERENCES

4.1 Literature Cited

Blackman, B.G. and K. Newsholme. 1993. *Williston Reservoir 1989 Creel Report.* Report No. 256. Peace/Williston Fish and Wildlife Compensation Program. Prince George, BC.

British Columbia Ministry of Environment (BCMOE). 2008. *Hunter Harvest Data*. Unpublished database maintained by BC Ministry of Environment. Victoria, BC.

British Columbia Ministry of Environment (BCMOE). 2009. *Hunting and Fishing Licence Sales*. Unpublished database maintained by BC Ministry of Environment. Victoria, BC.

British Columbia Ministry of Environment (BCMOE). 2012a. *British Columbia Freshwater Angling Guide 2012/2013*. Victoria, BC.

British Columbia Ministry of Environment (BCMOE). 2012c. *2012-2014 Hunting and Trapping Regulations Synopsis.* Victoria, BC.

Department of Fisheries and Oceans Canada (DFO). 2007. *Survey of Recreational Fishing in Canada in 2005*. Economic Analysis and Statistics Policy Sector. Ottawa, ON.

Department of Fisheries and Oceans Canada (DFO). 2012. *Survey of Recreational Fishing in Canada 2010*. Economic Analysis and Statistics Policy Sector. Ottawa, ON.

DPA Group Inc. (DPA). 1991. *Peace River Site C Sport Fishing Survey, 1989-1990*. Prepared for BC Hydro Environmental Resources Group. Vancouver, BC.

GSGislason & Associates Ltd. (GSGislason). 2003. *Building Blocks for Economic Development and Analysis, Freshwater Guiding and Lodges in BC*. An Economic Profile Prepared for British Columbia Ministry of Sustainable Resource Management. Victoria, BC.

GSGislason & Associates Ltd. (GSGislason). 2009. *Freshwater Sport Fishing in British Columbia: Sending Ripples through the Provincial Economy*. Prepared for Freshwater Fisheries Society of BC. Victoria, BC.

Hammond, R.J. 1980. *Peace Sub-Region Fisheries Management Statement.* British Columbia Fish and Wildlife Branch. Victoria, BC.

Hammond, R.J. 1986. *Peace River Summer Creel Census, 1985*. British Columbia Ministry of Environment and Parks, Recreational Fisheries Branch. Fort St. John, BC.

LGL Limited (LGL). 2010. *Peace River Angling and Recreational-Use Creel Survey 2008-2009*. Final Report. Prepared by D. Robichaud, M. Matthews, A. Blakely, and R. Bocking. Prepared for BC Hydro. Sidney, BC.

Pacific Analytics Inc. (Pacific Analytics). 2003. *The Guide Outfitting Industry in BC: An Economic Analysis of 2002*. Main Report. Prepared for Guide Outfitters Association of BC. Richmond, BC.

Statistics Canada. 2007. *Peace River, British Columbia* (Code 5955) (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa, ON.

Statistics Canada. 2012. *Peace River, British Columbia* (Code 5955) (table) Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa, ON.

Stiemer, R. 2006. *2005 Dinosaur Reservoir Creel Survey Report*. Report No. 306. Peace/Williston Fish and Wildlife Compensation Program. Prince George, BC.

Synergy Applied Ecology. 2011. *BC Hydro Williston Reservoir Recreation Use Monitoring Program, Data Report Year 2 (2010).* Prepared by J.C. Cubberley and P.E. Hengevold. Mackenzie, BC.

Tourism British Columbia (Tourism BC). 1998. *The Report on Visitors to Northern British Columbia Tourism Region: Northeast. Destination Report*. British Columbia Visitor Study Report on Travel in British Columbia. Victoria, BC.

4.2 Internet Sites

British Columbia Ministry of Environment (BCMOE). 2012b. *Fish Stocking Reports*. Available at: http://gofishbc.com/fish-stocking-reports.aspx. Accessed: April 2012.

Guide Outfitters Association of British Columbia (GOABC). 2012a. *Omineca Guide Outfitter Areas*. Available at: http://www.goabc.org/Regions/Region7a.aspx. Accessed: April 2012.

Guide Outfitters Association of British Columbia (GOABC). 2012b. *Peace Guide Outfitter Areas*. Available at: http://www.goabc.org/Regions/Region7b.aspx. Accessed: April 2012.

Guide Outfitters Association of British Columbia (GOABC). 2012c. *Outfitter Directory*. Available at: http://www.goabc.org/outfitter-directory-and-hunt-guide-directory.aspx. Accessed: April 2012.

Northern BC Tourism Association. 2012. Hudson's Hope Lodges. Available at: http://www.northernbc.worldweb.com/HudsonsHope/Lodging/Lodges/. Accessed: April 2012.

4.3 Personal Communications

British Columbia Ministry of Environment (BCMOE). 2009a. Fish Biologist, Gerry Leering. Telephone conversations. October 27, 2008 and March 30, 2009.

British Columbia Ministry of Environment (BCMOE). 2009b. Wildlife Biologist, Conrad Thiessen. Telephone conversation December 3, 2009.

British Columbia Ministry of Environment (BCMOE). 2009c. Wildlife Biologist, Peace Regional Office, Rob Wood. Telephone conversation March 24, 2009.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2011a. Environmental Assessment Coordinator, Maurice Lirette. Email September 26, 2011.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2011b. Environmental Assessment Coordinator, Maurice Lirette. Email September 28, 2011.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2011c. Environmental Assessment Coordinator, Maurice Lirette. Email October 18, 2011.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2012. Environmental Assessment Coordinator, Maurice Lirette. Email February 8, 2012.

Chetwynd and District Rod and Gun Club. 2011. Members. Chetwynd, BC. In-person group interview in Chetwynd, BC November 30, 2011.

Eastman, D. 2009. Chetwynd and District Rod and Gun Club Treasurer. Telephone conversation January 14, 2009.

Go Fish BC. 2012. Staff. Email May 17, 2012.

Guide Outfitters Interviews. 2012. Interviews conducted by BC Hydro. Spring 2012.

Holland, J. 2009. North Peace Rod and Gun Club President. Fort St. John, BC. Telephone conversation June 13, 2009.

Hopkins, R. 2009. Custom River Adventures Owner. Fort St. John, BC. Telephone conversation and in-person interview in Fort St. John, BC. March 23, 2009 and December 1, 2011.

Hudson’s Hope Rod and Gun Club. 2011. Members. Hudson’s Hope, BC. In-person group interview in Hudson’s Hope, BC November 30, 2011.

Kosolowski, S. 2008. Hudson’s Hope Rod and Gun Club Past President. Hudson’s Hope, BC. Telephone conversation January 13, 2009.

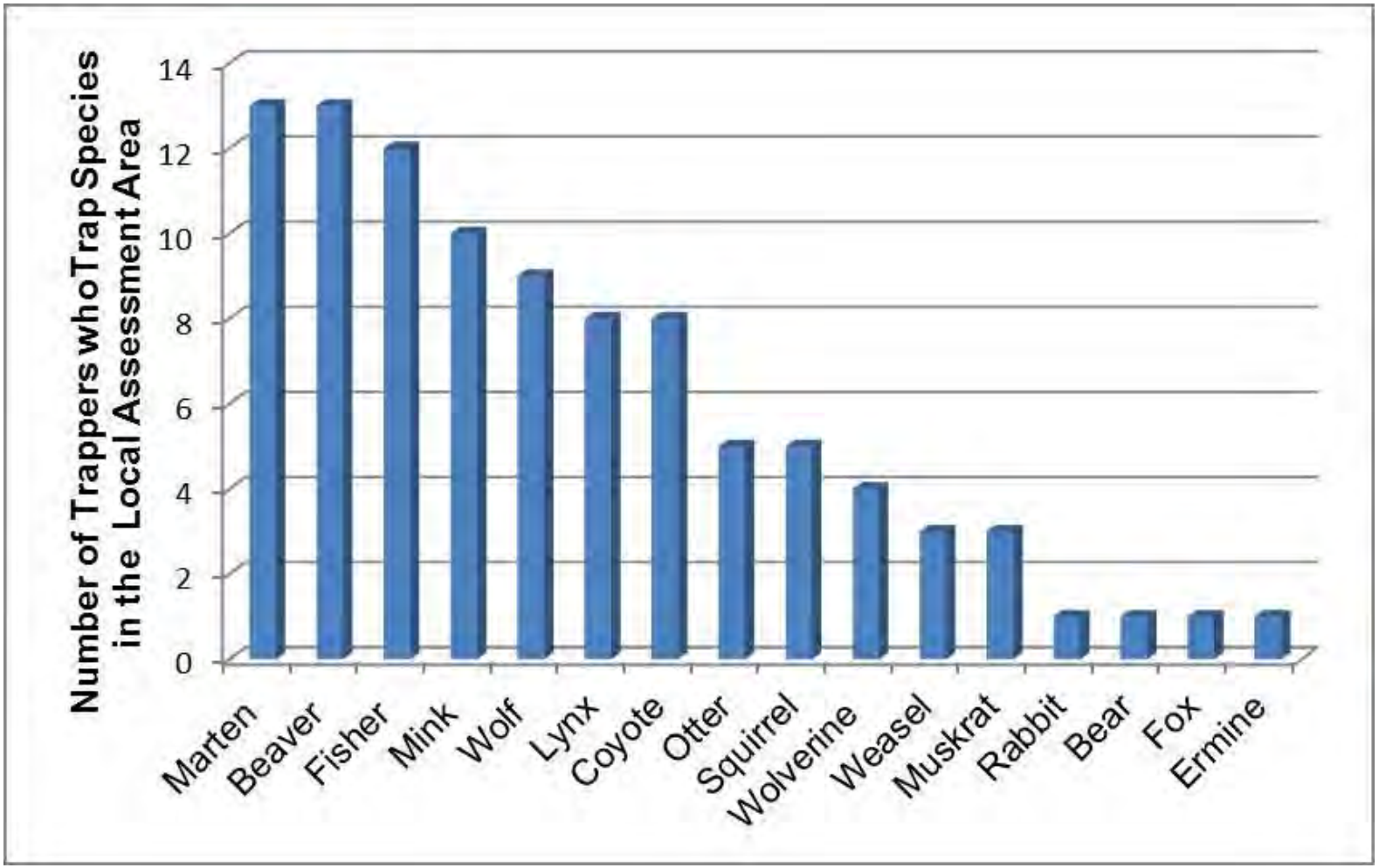
Mathias, B. 2009. Dawson Creek Sportsman’s Club. Dawson Creek, BC. Telephone conversation January 15, 2009.

Mayor, R. 2011. Dawson Creek Sportsman’s Club. Dawson Creek, BC. Telephone and in-person conversation in Fort St. John, BC. November 4 and 29, 2011.

North Peace Rod and Gun Club. 2011. Members. Fort St. John, BC. In-person group interview in Fort St. John, BC December 1, 2011.

Trapper Interviews. 2012. Interviews conducted by BC Hydro. April and May 2012.

Figure



NOTES:
SOURCE: TRAPPER INTERVIEWS (2012, PERS. COMM.)

BC hydro

SITE C CLEAN ENERGY PROJECT

Figure 1 Species trapped in the local assessment area

APPENDIX C

Part 5 Outdoor Recreation and Tourism, and Navigation

1 INTRODUCTION

This appendix provides supporting baseline information on outdoor recreation and tourism in the Peace Region. The baseline conditions described consider both the supply and demand of outdoor recreation and tourism in the Regional Assessment Area (RAA) and Local Assessment Area (LAA). The supply of outdoor recreation opportunities and the tourism they support is characterized by the recreation potential of the land base, parks and protected areas that are managed for outdoor recreation, and recreation-focused infrastructure, such as boat landings and camping sites. The types of outdoor recreation activities that occur in the region (including where they occur), participation and demand trends and use values are also discussed. The purpose of this appendix is to support Section 25 Outdoor Recreation and Tourism of the Site C Clean Energy Project EIS.

The navigation content of this appendix includes a BC Hydro memo confirming an approach to determine minimum vessel clearance envelopes for Highway 29 bridge crossings.

2 OUTDOOR RECREATION FEATURES AND AMENITIES

2.1 Recreation Sites

The Peace River Angling and Recreational Use Creel Survey (LGL 2010) identified a total of 49 recreation sites along the Peace River and its major tributaries, 32 of which were found throughout the Peace River mainstem, two on the Halfway River and 15 on the Pine River between the Sukunka and Peace River confluences. Total annual recreational activity level was estimated to be 15,909 user days, of which 10,353 user days were on the Peace River.

According to the survey results camping was the most common activity from May through September, and jet boating was the most popular in April, October and November (LGL 2010). Fishing was a popular activity from May through October, and hunting was popular in the fall. In the summer months, swimming, camping, picnicking and shoreline leisure were popular activities. Fishing and jet boating were the predominant activities upstream of the Project location, whereas camping and jet boating were most popular downstream of the Project and in the Pine River.

All 49 sites are accessible to the public by boat, and 20 are also accessible by road. Of the sites accessible by road, the access road to two of the Peace River sites crosses private land (confluence of Maurice Creek and Unmaintained Campsite E sites. Municipalities or private owners maintain the high-use campgrounds while the primitive, maintained campsites are kept up by the Peace Country River Rats boating club (i.e., designated Forest Recreation sites). BC Hydro maintains the high-use boat launches including Halfway River, Lynx Creek, and Peace Island Park. There are numerous unmaintained campsites, shoreline access sites, scenic locations and boat launches.

Recreation site types within the LAA are listed in Section 25 Outdoor Recreation and Tourism (Section 25.3 Baseline Description). Most of these sites were developed without

sanction from the province as stipulated in the Forest Practices Code of BC Act or the Forest and Range Practices Act (FRPA). Although not officially recognized by government, these sites do support ongoing river use for outdoor recreation purposes. BC Park signs are posted at some sites even though a provincial park does not exist. In most cases, sites were developed by volunteer labour or simply evolved over time through continuous use. Campsites are the most abundant site type, followed by shore access points and boat launches.

Recreation sites used by the public within the Project activity zone are also listed in Section 25 Outdoor Recreation and Tourism (Section 25.3 Baseline Description), including ten sites that are authorized under Section 57 and managed by the Peace Country River Rats Club. The current authorizations were signed in October 2009 for five years and will be re-evaluated at the end of the five year term. The sites are listed by location from Hudson's Hope downstream towards the Site C dam site.

2.2 Parks and Protected Areas

British Columbia has the second largest parks system (by area) in Canada, after Canada's National Parks. Over 13 million hectares, representing 14% of the province's total area, is protected. The parks serve an important role in protecting and conserving a wide range of critical habitats, much of which in a pristine wilderness setting, as well as fish and wildlife populations. They are also highly valued by B.C. residents for the opportunities they afford to hunt, fish, and pursue a variety of outdoor recreation activities.

Provincial parks contain approximately 6,000 km of hiking trails, 118 boat launches and 263 day-use areas. With more than 340 campgrounds and 11,000 campsites, BC Parks is the largest campground provider in the province.

The following list summarizes the results of a survey of B.C. residents completed by BCMOJTI (2010) which asked participants which activities they had participated in B.C. over the previous 12 months:

- Hiking day trip (53%)
- Beach activities, including picnicking at lake or river (52%)
- Swimming in lake or river (49%)
- Road biking or cycling (44%)
- Ocean-side beach activities, including picnicking (43%)
- Other nature viewing or scenic photography (38%)
- Vehicle access camping in a tent (29%)
- Bird watching (28%)
- Swimming in ocean (25%)
- Freshwater fishing (24%)
- Mountain biking on trails with no lift access (23%)
- Motorized boating on a lake or river (21%)
- Vehicle access camping in an RV or motorhome (20%)
- Downhill skiing/snowboarding with lift access (19%)
- Whale watching/other marine based wildlife (18%)
- Bear watching (17%)
- Canoeing on a lake or river (16%)

- Motorized boating on the ocean (15%)
- Visiting non-resort based hotsprings (14%)
- Non-vehicle access camping in a tent, cabin or hut (14%)
- ATV riding (12%)
- Saltwater fishing (12%)
- Horseback riding (11%)

Activities noted in the Northern B.C. region accounted for 6% of all responses, and of those respondents an average of 10 activities were noted per response. For these respondents, the top activities in Northern B.C. were:

- Beach activities, including picnicking at a lake or river (63%)
- Swimming at a lake or river (56%)
- Hiking – day trip (53%)
- Freshwater fishing (50%)
- Other nature viewing or scenic photography (47%)

The Northeast region of the province offers some of the world's best outdoor experiences, many of which are captured within parks. The Muskwa-Kechika Management Area itself has 2.5 million hectares of permanently protected land, including Northern Rocky Mountains Provincial Park, the third largest provincial park in British Columbia at 665,709 hectares. Wokkpash Recreation Area, Stone Mountain Provincial Park and Kwadacha Wilderness Provincial Park are other notable parks.

The parks in the Peace Region (Table 1) tend to be smaller and less oriented to wilderness values than their counterparts to the north and to the south, in part due to the long history of settlement along the river and the prevalence of agricultural activity. The parks, with a total area of 9,650 hectares, protect lake and river habitats mainly for local resident use, although the three parks downstream of Taylor are managed for their wilderness values. Campgrounds, day-use areas and boat launches accommodate camping, boating, fishing, hunting, wildlife viewing, hiking and other water-based activities.

B.C. Park attendance records are kept for three of the nine provincial parks in the RSA: Beatton, Charlie Lake and Kiskatinaw (Table 2). Campground attendance is increasing at Charlie Lake but is declining at Beatton and Kiskatinaw parks. Campground revenue is decreasing in Beatton and Kiskatinaw parks and in the region as a whole. Day use area attendance has increased at Kiskatinaw and in the region but has declined at Beatton and Charlie Lake parks.

Table 1 Provincial parks in the regional assessment area

Provincial Park	Area (ha)	Location	Primary Management Purpose	Facilities	Activities
Moberly Lake	104	25 km northwest of Chetwynd	resident recreation	boat launch, campground, day-use area, washrooms, sani-station	canoeing, cycling, fishing, hiking, swimming, waterskiing, windsurfing
Kiskatinaw	54	28 km north of Dawson Creek	resident recreation	campground, day-use area, washrooms	cycling, swimming, fishing
Kiskatinaw River	198	Peace River, 10 km from the Alberta Border	not applicable	none	canoeing, cycling, fishing, hiking, horseback riding, hunting, swimming, wildlife viewing
Peace River Corridor	2,014	Peace River, 25 km from the Alberta border	not applicable	wilderness camping	canoeing, fishing, hiking, horseback riding, hunting, wildlife viewing
Beatton River	186	Peace River at confluence of Beatton and Peace	riparian habitat protection; Fort St. John recreation opportunities	none	canoeing, fishing, hiking, horseback riding, hunting, wildlife viewing
Taylor Landing	2.4	1 km south of Taylor	recreation access to river	washrooms	canoeing, fishing
Beatton	310	13 km northwest of Fort St. John	resident recreation	boat launch, campground, day-use area, washrooms	canoeing, cycling, fishing, hiking, swimming, waterskiing, windsurfing, winter recreation
Charlie Lake	85	11 km north of Fort St. John	resident and local club recreation	boat launch, campground, day-use area, washrooms, sani-station	canoeing, cycling, fishing, hiking, swimming, interpretive programs
Butler Ridge	6,686	25 km west of Hudson's Hope	not applicable	boat launch, washrooms, wilderness camping	canoeing, cycling, fishing, hiking, horseback riding, hunting, swimming, wildlife viewing, winter recreation

NOTES:
ha – hectares
km – kilometre
SOURCE:
BC Parks (2012)

Table 2 Provincial park attendance and revenue in the regional assessment area and Peace Region

Park	2008-2009	2009-2010	2010-2011	Difference 2008-2011	
				No.	%
Beatton					
Campground attendance	8,768	9,341	8,595	-173	-2.0
Campground revenue	$38,732	$43,661	$40,757	$2,025	5.2
Day use area attendance	46,701	49,879	41,430	-5,271	-11.3
Charlie Lake					
Campground attendance	9,702	10,285	10,749	1,047	10.8
Campground revenue	$44,101	$42,949	$46,941	$2,840	6.4
Day use area attendance	44,762	44,450	43,281	-1,481	-3.3
Kiskatinaw					
Campground attendance	3,680	3,974	3,424	-256	-7.0
Campground revenue	$11,543	$17,669	$15,535	$3,992	34.6
Day use area attendance	10,448	24,164	22,967	12,519	119.8
Peace Region					
Campground attendance	86,454	89,062	83,903	-2,551	-3.0
Campground revenue	$406,168	$430,438	$423,806	$17,638	4.3
Day use area attendance	297,630	404,509	362,823	65,193	21.9

SOURCES:
BC Parks (2010, 2011)

The proposed Peace River Boudreau Lake protected area is located between Hudson's Hope and Fort St. John and encompasses a major portion of the south bank of the Peace River valley, the lower Moberly River valley, and the Peace River Islands between Maurice Creek and Moberly River. This protected area was first proposed for protection in the Fort St. John and Dawson Creek LRMPs (BCMFLNRO 1997, 1999). The area protects specific cultural and heritage features including the first European settlement on mainland B.C. at Rocky Mountain Fort. The proposed park also protects ecosystem values such as old growth management areas and Boreal White and Black Spruce biogeoclimatic zone. Recreational activities supported include public and commercial boating, canoeing, bird watching, hunting and fishing, although current access to many parts of the proposed park are limited and use levels are low (BC Parks, Planning Officer 2009 pers. comm.).

Municipal parks in the area are located in central or high use areas and are described in Section 25 Outdoor Recreation and Tourism (Section 25.3 Baseline Description).

There are five regional parks and campgrounds in the Peace River Regional District (PRRD) (Table 3). Regional parks are free of charge. The PRRD is in the process of writing a Regional Parks and Trails Master Plan. The district has been consulting on the Plan and it is due for completion in late 2012. Feedback to date emphasizes that access to the Peace River is currently limited with expanded access a common public request. The PRRD has commented that connecting future Site C reservoir and boat access with a PRRD trail system would be beneficial; however, the district has limited funding and is looking for partnerships with the private sector and local user groups for trail expansion projects (Peace River Regional District, Manager of Community Services 2012, pers. comm.).

Table 3 Regional parks and campgrounds in the Peace River Regional District

Park	Location	Amenities	Activities
Blackfoot Park	75 km east of Fort St. John and 51 km north of Dawson Creek	10 campsites with fire pits and picnic tables, six outdoor toilets, playground, horseshoe pits and raw water well (boat launch not recommended for use)	camping
Montney Centennial Park	northeast shore of Charlie Lake	open campsites, a picnic area with fire pits, two outhouses and a rustic boat launch	camping boating, fishing
Minaker River Park	a quarter mile west of Milepost 200 on the Alaska Highway on the Minaker River flats	fire pits, picnic tables, outhouses and campsites	camping, fishing, hunting, hiking
Spencer Tuck Park	north side of Moberly Lake about 32 km north of Chetwynd	six fire pits, picnic tables, outhouses and a boat launch	day use, boating
Sundance Lake Regional Park	on Sundance Lake, just off of Highway 97S approximately 15 km east of Chetwynd	picnic and rest area	day use, fishing

SOURCE:
Peace River Regional District (2012)

3 TOURISM FEATURES AND AMENITIES

3.1 Tourism Businesses

Estimates of the number of tourism-related businesses in the area adjacent to the Project activity zone are shown in Table . These data, compiled as part of the Site C creel and recreation study, indicate the area has in the range of 40% to 45% of all accommodation properties in the Northeast. In total, 143 businesses were either predominantly tourism-oriented or catered to travelers as a secondary market.

The 81 service businesses counted in Table include 12 outdoor adventure operators who offer guided services to visitors. A check of members listed on the NRAHTA website show four of these companies to be registered guide outfitters who cater predominantly to big game hunters. Most of the rest specialize in backcountry adventures in the remote wilderness, including the Muskwa-Kechika management area. The one jet boat operator who offers custom tours of the Peace River guided approximately 18 tourists in 2008

(Hopkins 2011, pers. comm.). Visitors are generally interested in sightseeing, wildlife viewing and nature viewing. No other companies appear to specialize in Peace River adventures.

Table 4 Businesses supporting tourism and recreation on the Peace River, 2010

Business Type	Fort St. John	Taylor	Hudson's Hope	Total
Accommodation	26	3	11	40
Service	69	3	9	81
Transportation	19	1	2	22
Total	**114**	**7**	**22**	**143**

NOTES:
Accommodation includes hotels, motels, bed & breakfasts, campgrounds.
Service includes food stores, restaurants, sporting goods stores and outfitting or adventure companies.
Transportation includes gas stations, RV, all terrain vehicle and snowmobile rentals.

SOURCE:
LGL (2010)

A tourism operator who provides outdoor recreation services for compensation or reward from residents or non-residents on provincial Crown land must be authorized by the province and issued an Adventure Tourism tenure (BCMFLNRO 2011a). The policy applies to activities that require extensive operating areas on Crown land, any improvements on Crown land and floating facilities anchored to Crown land covered by water that are linked to licensed angling guides and guide outfitters. There are no tenures overlapping or near the Project activity zone.

3.2 Accommodation Facilities

A profile of visitor accommodation facilities in the LAA and RAA is presented in Section 35 Housing and recapped in Table .

Table 5 Temporary accommodation in regional assessment area communities, 2011

Accommodation Type	Ft. St. John		Taylor		Hudson's Hope		Chetwynd	
	Sites	Units	Sites	Units	Sites	Units	Sites	Units
Campground/RV	5	270	2	118	5	116	6	289
Hotel and Motel	21	1,400	2	26	3	173	10	424
Lodges & Camps	0	0	0	0	2	20	4	78
B & B	1	2	0	0	1	3	3	5
Total	**27**	**1,672**	**4**	**144**	**11**	**312**	**23**	**796**

SOURCE:
Volume 4 Section 35 Housing

4 OUTDOOR RECREATION USE LEVELS

Table shows the most common river access points for each month. The boat launch at Peace Island Park is the most frequently used access point to the Peace River. Access occurred in early spring to late fall with a peak in activity in July and August. Of the participants who accessed the river from Peace Island Park, 10% went upstream passed the Site C dam site towards Hudson's Hope and Peace Canyon Dam. Another 30% traveled into the Pine River (LGL 2010).

Table 6 Number of participants by month and river access site, 2008-2009

Activity	All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Peace Island Park	3,263	3	0	0	85	136	705	959	935	386	40	13	1
Clayhurst	524	0	0	0	20	78	126	144	101	45	10	0	0
Alwin Holland Park	428	0	0	0	11	68	76	64	158	45	6	0	0
Lynx Creek RV Park	410	0	0	0	0	107	88	96	72	39	8	0	0
Lynx Creek Launch	352	2	3	0	21	29	88	112	43	52	2	0	0
Hudson's Hope Launch	171	0	0	2	32	39	13	64	14	6	1	0	0
Halfway River Bridge	147	5	0	0	0	15	13	32	58	6	18	0	0
Twidwell Bend	145	0	0	0	5	5	0	80	29	26	0	0	0
Sukunka Road	127	0	0	0	0	5	113	0	0	6	3	0	0
East Pine	90	0	0	0	0	5	13	32	14	26	0	0	0
Highway 29 bridge	85	0	0	0	4	24	38	16	0	0	3	0	0
Farrell Creek Mouth	6	0	1	0	0	5	0	0	0	0	0	0	0
Total	**5,748**	**10**	**4**	**2**	**178**	**516**	**1,273**	**1,599**	**1,424**	**637**	**91**	**13**	**1**
People interviewed	5,722	10	3	2	178	485	1,259	1,598	1,438	644	91	13	1

SOURCE:
LGL (2010)

5 REGIONAL TOURISM VISITOR LEVELS

5.1 Visitor Estimates

The estimated number of visitors and their spending in the North Peace in 2007 is presented in Table and Table , respectively. The estimates were made in a 2009 study commissioned by the North Peace Economic Development Commission with support by Tourism B.C. and the Northern Rockies Alaska Highway Visitors Association (Bass 2009). Fort St. John hosted 176,300 visitors in 2007, while another 47,000 visited other communities or rural areas in the North Peace, including Hudson's Hope and Taylor. Eighty-one percent of visitors stayed in commercial accommodations, with all but a handful of the remainder staying with friends and relatives. Roughly four in five of those staying in commercial accommodations opted for fixed roof facilities, including hotels, motels, B&Bs and vacation rentals. The other 20% used RV and camp sites.

The importance of business travel to the regional tourism economy was a highlight of the study. More than 40% of all visitors in 2007 had business as a primary trip purpose, versus 17.9% visiting friends and relatives and the remaining 40% primarily leisure visitors. The proportion of business travelers may actually be higher than estimated in the study if RV and camp users and those visiting friends and relatives were also conducting business while in the region.

Table 7 Estimate of visitors to Fort St. John and the North Peace, 2007

Type of Visitor	Fort St. John	Other North Peace	Total North Peace	% of Total
Leisure	46,300	2,800	49,100	22.0
Business	91,200	2,900	94,100	42.1
RV and Campground	15,800	23,000	38,800	17.4
Total Commercial Accommodations (Sub-total)	**153,300**	**28,700**	**182,000**	**81.5**
Visiting Friends and Relatives	21,900	18,000	39,900	17.9
Day Visitors	1,100	300	1,400	0.6
Overall Visitation (Grand Total)	**176,300**	**47,000**	**223,300**	**100.0**

SOURCE:
Bass (2009)

Table shows spending by major visitor segments in 2007 for Fort St. John and the North Peace region. Total visitor spending was estimated at $64 million in Fort St. John and $9.2 million in the North Peace for a cumulative total of $73.2 million. Business visitors accounted for 72.6% of this spending, a significant share of the total spending. This is a result of business visitors staying longer and having higher average daily expenditures than leisure travelers or day visitors or visitors who stay with friends and relatives.

Table 8 Estimate of visitor expenditures in Fort St. John and the North Peace, 2007

Type of Visitor	Fort St. John			Other North Peace			Total North Peace
	Length of Stay (days)	Per Visitor Trip Spending ($)	Total Spending ($M)	Length of Stay (days)	Per Visitor Trip Spending ($)	Total Spending ($M)	Total Spending ($M)
Leisure	1.3	140	8.4	1.6	120	3.0	11.5
Business	2.7	560	50.9	6.2	810	2.3	53.2
Visiting Friends and Relatives	4.0	210	4.6	4.0	210	3.8	8.4
Day Visitors	N/A	80	0.1	N/A	80	0.02	0.1
Annual Direct Expenditures (Sum)	N/A	N/A	64.0	N/A	N/A	9.2	73.2

NOTES:
Differences in totals are due to rounding
N/A - Not applicable

SOURCE:
Bass (2009)

5.2 Visitor Centre Attendance

The three municipalities in the LAA maintain Tourism B.C. approved visitor centres which serve travelers through professional visitor counseling, travel information and literature, community information, itinerary planning and, in some cases, accommodation reservations. All visitor centres keep track of visitor attendance as a condition of membership in Tourism B.C.'s Visitor Centres Network.

Visitor centre attendance between 2002 and 2010 is shown in Figure 1. Combined attendance was up approximately 8% during this period. Fort St. John and Taylor showed increases of around 40%, while attendance in Hudson's Hope declined almost by half. Visitor centre attendance in the North Peace is in contrast to visitation at South Peace visitor centres (Dawson Creek, Pouce Coupe, Chetwynd and Tumbler Ridge) which has declined sharply over the past 10 years.

The reasons for the divergent trends in the north versus the south may have to do with location, parking, signage, ease of access, building condition, weather conditions, service levels and hours of operation, among others.

The seasonality of visitor centre attendance is illustrated in Figure 2. Over 90% of visitors use the centres in the May to September period. Attendance is much lower in the off-season when touring traffic on the Alaska Highway and visits to friends and family drop off. The attendance totals in Figure 2 are skewed by the fact that Taylor and Hudson's Hope centres are not open before or after the peak summer season, but attendance at the year-round centres in the region (Fort St. John, Dawson Creek, Chetwynd and Tumbler Ridge) show a similar seasonal pattern.

Attendances at the Peace Canyon Dam and W.A.C. Bennett Dam visitor centres are shown in Table . Attendance levels of over 20,000 visitors annually were recorded regularly in the late 1990s but dropped markedly in 2002 after the 9/11 terrorist attacks, when dam tours were cancelled. Attendance has recovered since 2004 but remains well below pre-2001 levels.

Table 9 WAC Bennett & Peace Canyon visitor centre attendance, 2001-2011

Visitor Centre	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
WAC	14,359	9,978	14,561	8,800	12,300	12,508	12,805	11,091	10,509	12,803	13,630
PCN	3,000	3,000	3,000	3,000	3,000	3,000	3,652	2,413	3,438	3,103	3,088
Total	**17,359**	**12,978**	**17,561**	**11,800**	**15,600**	**15,508**	**16,457**	**13,504**	**13,947**	**15,906**	**16,718**

NOTES:
WAC – W.A.C. Bennett Dam Visitor Centre
PCN – Peace Canyon Dam Visitor Centre
SOURCE:
BC Hydro (2011)

5.3 Visitor Estimates for Peace River

The number and origin of tourists using the Peace River are not known, but the Peace River creel and recreation study has provided some preliminary baseline data. As indicated in Table , during the 2008 field season, 15% of all people interviewed lived outside the RAA, which would qualify them as tourists.

Table 10 Residency of respondents to Peace River creel and recreational use survey interviews, by month

Residency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Number of Users[a]	7	0	0	136	410	1128	1454	1314	560	73	0	0	5096
% Led by Guide	0	0	0	0	0	2	2	0	0	0	0	0	0.98
Residence													
% Peace Area	100	0	0	77	90	78	87	89	74	95	0	0	84
% Rest of B.C.	0	0	0	13	6	7	5	3	16	3	0	0	6
% Rest of Canada	0	0	0	10	1	12	7	7	10	3	0	0	8
% US	0	0	0	0	2	2	1	0	1	0	0	0	1
% Other	0	0	0	0	1	0	0	1	0	0	0	0	0

NOTES:
a addition error on row is from source data
SOURCE: LGL (2010)

5.4 Visitor Characteristics

According to the most recent travel survey in Northeast B.C., as shown in Table , about one half of all overnight travelers to the region are Canadians and 45% Americans (NRAHTA 2005). B.C. and Alberta residents account for 70% of Canadian travelers while Alaska, California, Washington, Michigan, Florida and Texas are the primary sources of US travelers. Germany and Switzerland account for most of the European

visitors. This profile has changed little since the last comprehensive B.C. visitor exit survey in 1996 (Tourism BC 1998).

Table 11 Origin of travellers to Northeast B.C., 2005

Origin	% of Travelers
Canada	49
B.C.	20
Alberta	14
Yukon	2
Ontario	7
Other Canada	7
United States	45
Alaska	10
Pacific	8
Mid-West	9
South	10
New England	3
Overseas	6
Europe	5
Asia Pacific	1
Other	<1

NOTE:
May not sum to 100% due to rounding
SOURCE:
NRAHTA (2005)

Travelers to Northeast B.C. are different in terms of age and travel party composition from other travelers in B.C. More than half were over 55 years of age; a quarter were 65 and older. Most people were travelling in parties of two or four, and less than 15% were travelling with children (NRAHTA 2005). The preponderance of older travelers, including a substantial portion of senior citizens, is attributable to the high proportion of Alaska-bound US and European residents.

Most independent travelers to or within Northeast B.C. were on a leisure trip (Table 12). Another 9% were visiting friends and relatives and 5% were on a business trip. Visiting friends and relatives as a primary trip purpose was higher among Canadians, compared to US or overseas travelers. Most of the US travelers in the Other category were moving to or from Alaska.

Table 12 Trip purpose of travellers to Northeast B.C., 2005

Traveler Origin and Age	Percentage			
	Leisure	Visit friends & relatives	Business	Other
Overall	83	9	5	3
Origin				
Canada	82	11	5	1
United States	82	6	6	5
Overseas	96	3	1	<1
Age				
Under 35 years	75	9	6	9
35 to 54 years	81	9	7	3
55 to 64 years	86	8	6	1
65 years and older	86	9	3	2

NOTE:
May not sum to 100% due to rounding
SOURCE:
NRAHTA (2005)

Only 15% of travelers to Northeast B.C. said the region was their primary destination (Table). Close to one-half of all travelers were going to or coming from Alaska. Most of the remaining travelers were destined either for the Yukon or were on a circle tour with no specific destination (nearly 15% each). The destination of choice among Americans and Europeans was Alaska, while older travelers also preferred Alaska. Travelers who were visiting friends and relatives or on business were more likely to be destined for Northeast B.C., compared to leisure travelers.

The NRAHTA traveler study confirms what is generally seen as the dual nature of the Alaska Highway visitor market—a high proportion of US visitors to and from Alaska who use the Northeast simply as a travel corridor, and a core market of regional visitors from B.C. and Alberta.

Table 13 Main destination of travellers to Northeast B.C., 2005

Traveller Origin, Age and Purpose	Percentage						
	Alaska	Northeast B.C.	Yukon Circle Tour		Other B.C.	Alberta	Other
Overall	46	15	13	13	3	2	8
Origin							
Canada	20	27	24	17	5	3	4
United States	76	2	1	6	0	1	14
Overseas	40	8	11	31	6	1	3
Age							
Under 35 years	40	18	13	14	3	2	9
35 to 54 years	39	18	14	13	4	3	10
55 to 64 years	51	12	14	12	2	2	7

Traveller Origin, Age and Purpose	Percentage						
	Alaska	Northeast B.C.	Yukon Circle Tour		Other B.C.	Alberta	Other
65 years and older	53	11	11	14	3	1	7
Trip purpose							
Leisure	49	11	13	14	3	2	7
Visit friends & relatives	21	34	15	8	6	4	11
Business	35	30	9	8	1	2	15

NOTE:
May not sum to 100% due to rounding
SOURCE:
NRAHTA (2005)

The natural environment is an important travel motivator for visitors to the Northeast (Figure 3). When travelers were asked to rate the importance of specific statements in their decision to take their trip to or travel north, over 60% stated that the key motivators were the desire to see wild places and to have new experiences. An estimated 70% of travelers indicated that opportunities to enjoy outdoor activities or to travel in safe places were also important or very important to their decision to take their trip. Historical or cultural motivators (e.g., history of the Alaska Highway, local way of life, and/or First Nations culture) had lower importance ratings.

Table shows participation rates for selected activity by visitor origin. Participation rates for many activities were relatively consistent among the different visitor origins. Visiting a park, walking, hiking or cycling, and going shopping were all within plus or minus 10 points of the overall participation rate. Considerable variation emerged among the other activities, although the longer- stay, Alaska-bound travelers tended to have higher rates across the board. Travelers destined for Northeast B.C. had lower participation rates for most activities, except walking, hiking and cycling. Close to one-third of all travelers, and one half of overseas visitors, participated in industrial tourism, that is, to local mills, BC Hydro visitor centres or other guided tours.

Table 14 Participation rates for selected activities by travellers to Northeast B.C. (%), 2005

Activities	Overall	Canada	US	Other
Visiting a park (state, provincial or national)	89%	86%	93%	89%
Visiting a museum, heritage or historic site	85%	87%	81%	87%
Walking, hiking or cycling	77%	81%	72%	80%
Go shopping	72%	72%	74%	68%
Unguided outdoor activities	61%	58%	63%	72%
Visiting an art gallery or a studio	47%	52%	42%	53%
Take a day cruise or a boat trip	47%	37%	57%	58%
Attend an aboriginal or native cultural attraction or event	40%	37%	42%	53%
Visit an industrial attraction (BC Hydro Dam,	31%	35%	24%	49%

Activities	Overall	Canada	US	Other
forestry mill, etc.)				
Attend a fair, festival or exhibition	31%	26%	37%	33%
Guided outdoor activities	24%	18%	30%	29%
Visit a family attraction (mini golf, zoo, etc.)	21%	18%	22%	32%
Flight seeing (in an airplane or helicopter)	14%	14%	14%	20%
Participate in or attend a sporting event other than golf	10%	9%	10%	9%
Participate in or attend a golfing event	7%	7%	5%	8%

SOURCE:
NRAHTA (2005)

6 REFERENCES

6.1 Literature Cited

Bass, J. 2009. *North Peace Region Value of Tourism Study*. Prepared for the North Peace Economic Development Commission. Edmonton, AB.

BC Hydro. 2011. *Visitor Attendance at WAC Bennett and Peace Canyon Dam Visitor Centres.* Years 1998 to 2011. Unpublished database on file at BC Hydro. Vancouver, BC.

BC Parks. 2010. *2009/10 BC Parks Year End Report*. Victoria, BC.

BC Parks. 2011. *2010/11 Statistics Report*. Victoria, BC.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 1997. *Fort St John Land and Resource Management Plan*. Victoria, BC.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 1999. *Dawson Creek Land and Resource Management Plan*. Victoria, BC.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2011a. *Land Use Operational Policy Adventure Tourism*. Victoria, BC.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO). 2011b. *Commercial Recreation Tenures and Applications within the Peace River Corridor Between Williston Lake and Taylor* (Map). Victoria, BC.

BC Ministry of Jobs, Tourism and Innovation (BCMOJTI). 2010. *BC Resident Outdoor Recreation Survey.* Research, Planning & Evaluation Branch. Victoria, BC.

LGL Limited (LGL). 2010. *Peace River Angling and Recreational-Use Creel Survey 2008-2009*. Final Report. Prepared by D. Robichaud, M. Matthews, A. Blakely, and R. Bocking. Prepared for BC Hydro. Sidney, BC.

Northern Rockies Alaska Highway Tourism Association (NRAHTA). 2005. *Northern Rockies - Alaska Highway Visitor Research Project FINAL REPORT*. Prepared by Tourism BC Research Services. Fort St. John, BC.

Tourism British Columbia (Tourism BC). 1998. *The Report on Visitors to Northern British Columbia Tourism Region: Northeast. Destination Report. British Columbia Visitor Study Report on Travel in British Columbia*. Victoria, BC.

Tourism British Columbia (Tourism BC). 2011. *Visitor Centre Network Statistics Program Year Over Year Report 2011*. Data for 2002 to 2010 for Hudson's Hope, Fort St. John, Dawson Creek, Taylor, Chetwynd, Pouce Coupe and Tumbler Ridge. Victoria, BC.

Tourism British Columbia (Tourism BC). 2012. *Hudson's Hope Tourism Planning Workshop Report.* Community Tourism Foundation Program. Victoria, BC.

6.2 Internet Sites

BC Parks. 2012. Find a Park. Available at: http://www.env.gov.bc.ca/bcparks/explore/. Accessed April 2012.

Peace River Regional District. 2012. *Local Parks*. Available at: http://www.prrd.bc.ca/services/parks_and_recreation/local_parks.php. Accessed: April 2012.

6.3 Personal Communications

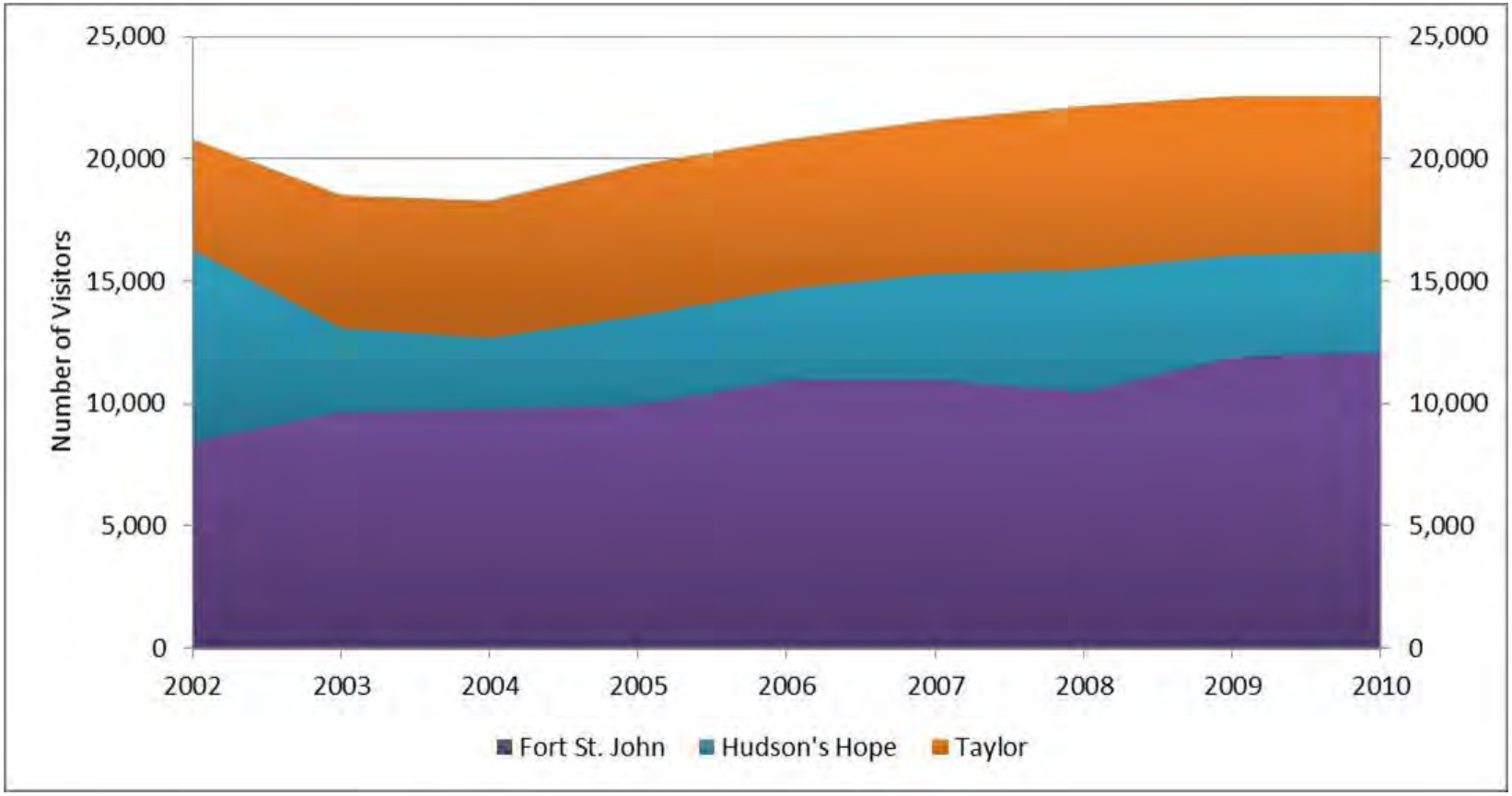
BC Parks. 2009. Planning Officer, Scott Fraser. Telephone conversations between November 2008 and April 2009.

Dancey, D. 2008. Northland Trailblazers. Fort St. John. Telephone conversation December 5, 2008.

Hopkins, R. 2011. Custom River Adventures Owner. Telephone conversation and in-person interview in Fort St. John, BC. March 23, 2009 and December 1, 2011.

Peace River Regional District. 2011. Manager of Community Services, Trish Morgan. Email October 13, 2011.

Figures: Volume 3 Appendix C

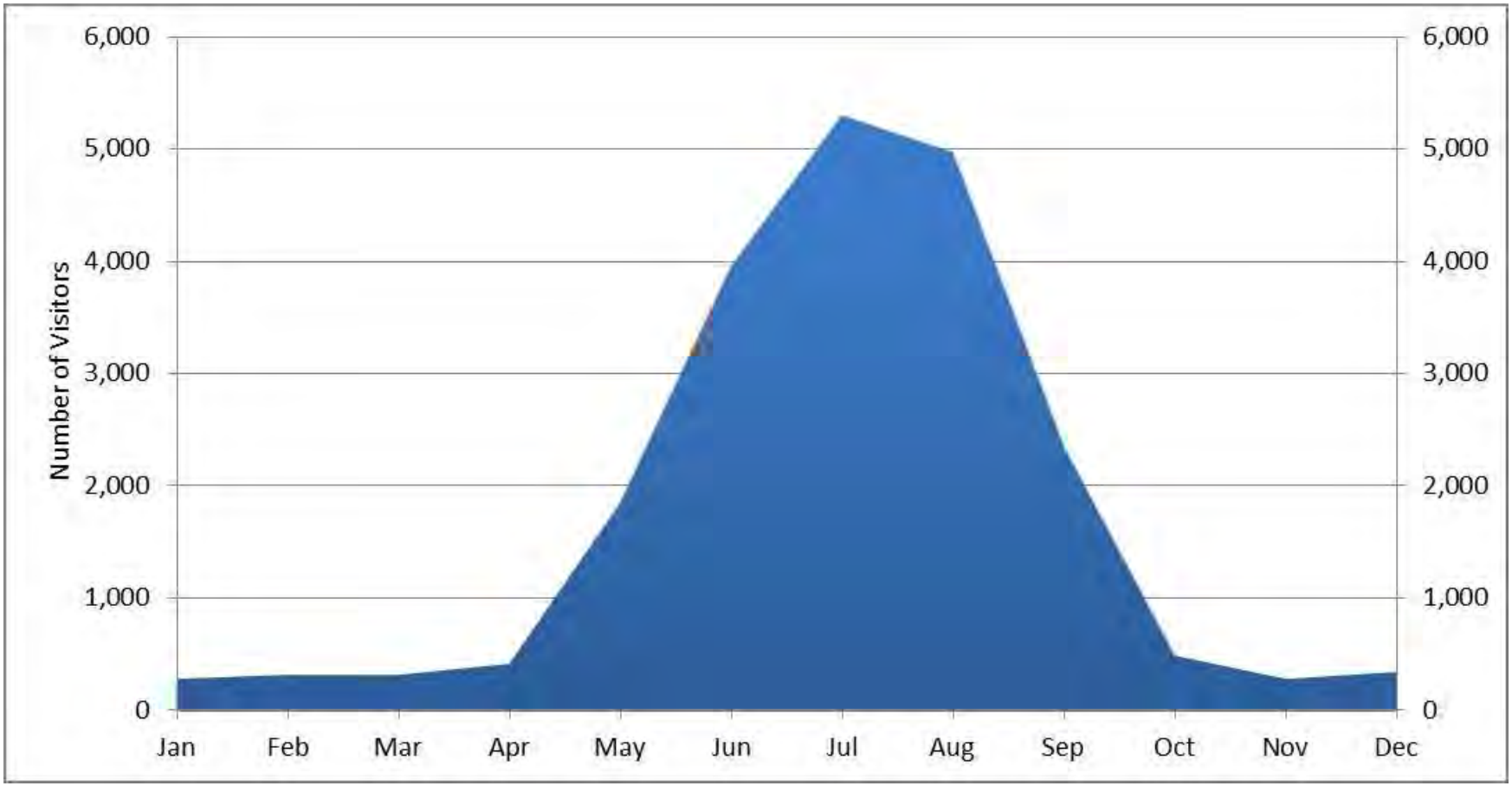


SOURCE:
TBC (2011)

BC hydro

SITE C CLEAN ENERGY PROJECT

Figure 1 Fort St. John, Hudson's Hope and Taylor Visitor Centre attendance, 2002-2010

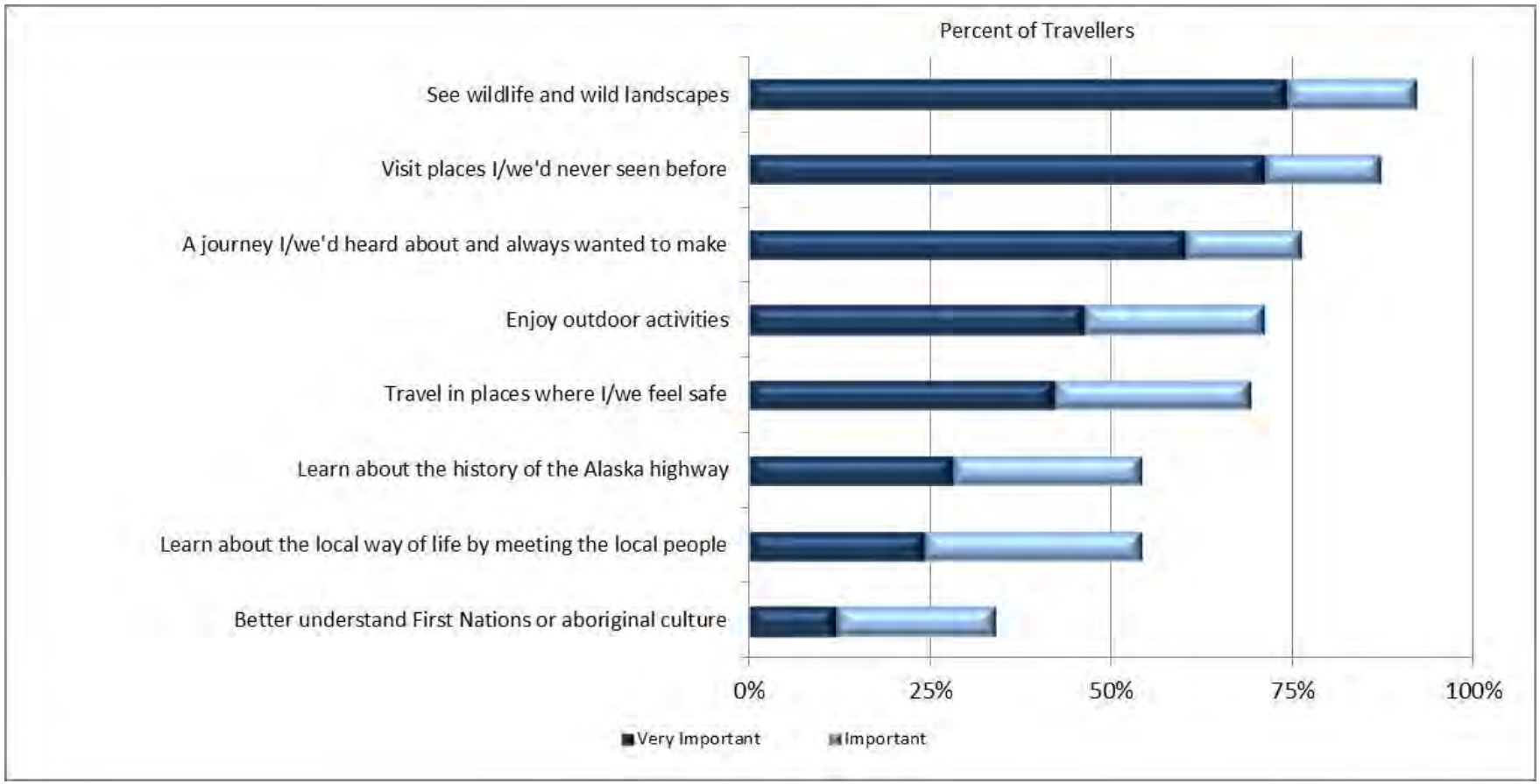


SOURCE:
TBC (2011)

BC hydro

SITE C CLEAN ENERGY PROJECT

Figure 2 Peace River Regional District average monthly visitor centre attendance, 2002-2010



SOURCE:
NRAHTA (2005)

Figure 3 Importance of motivators for taking a trip to northeast BC

BC Hydro Memo: Navigational Clearances for Highway 29 Bridge Crossings

SITE C CLEAN ENERGY PROJECT

To:	Siobhan Jackson Socio-Economic and Heritage Manager Site C Clean Energy Project	5 January 2013
From:	Alex Izett, P.Eng. Owner's Engineer, Road and Bridge Infrastructure Site C Clean Energy Project	
CC:	Don Wharf, Dave Hunter	
Subject:	**Site C Clean Energy Project: Navigational Clearances for Highway 29 Bridge Crossings**	

Issue: Navigational clearance envelopes under four proposed Highway 29 Bridge crossings.

Purpose

- In order to advance the preliminary and definition design options for Highway 29, the BC Hydro Integrated Engineering team developed an approach to determine minimum vessel clearance envelopes at Lynx Creek, Farrell Creek, Halfway River, Cache Creek, and possibly Dry Creek.

- The Site C Clean Energy Project team requests Transport Canada consideration of and, as appropriate, feedback on or endorsement of the proposed navigational clearances for Highway 29 Bridge Crossings as a component of the Environmental Impact Statement (EIS) submission, including the design basis and assumptions, as described in this memorandum.

- This memorandum is largely similar to that dated 11 October 2011, issued to Transport Canada, but updates certain points to reflect the completion of Definition Design.

Background

- The Site C reservoir and associated realignment of Highway 29 will result in construction of up to five bridge crossings.

- Preferred alignment and corridor options at each of the locations were identified at the conclusion of Definition Design in mid-2012, giving consideration to financial, safety, social, and environmental aspects. Options are shown on figures 26.1 – 26.4 included in Volume 3 Section 26 Navigation, of the EIS.

- Due to the broad nature of commercial and recreational navigation and the varied types of vessels used to navigate (canoes to cruisers and larger) it was difficult to confirm a set clearance envelope standard for all situations in all of Canada.

- Research of other jurisdictions and organizations such as Coast Guard Canada, The United States Coast Guard and The United States Army Corps of Engineers did not provide any definitive standards with respect to clearance envelopes and recreational boating.

Approach

- Reference information was obtained from The Oregon State Marine Board Policy-Procedures for Minimum Channel Clearance Guidelines for Recreational Boating.

- Through a rationalized approach, the Site C Integrated Engineering team established navigation clearance envelopes on the basis of providing safe navigation for recreational boaters and small commercial boats reasonably expected to be navigating the reservoir or the tributaries.

- Consideration was given to the bathymetric and topographic characteristics at each crossing location obtained from LIDAR information and BC Hydro modeling in determining the type of boats that could reasonably be expected to be used in water conditions at the greater of the 100 year flood event (Q_{100}) or reservoir fully supply level combined with Peace Canyon Generating Station controlled discharge of 5,278 m^3s.

- Input was provided by individuals experienced with the *Navigable Waters Protection Act*, boaters and information obtained from other sources.

Recommendation

- Boat classifications are from the Oregon State Marine Board Policy-Procedures Minimum Channel Clearance Guidelines for Recreational Boating and "are the most likely vessels used on the generic class of waterway. Actual use may differ according to local regulations or conditions that limit use by certain types of boats." Assuming flatwater conditions, propeller boats of 27 ft to 40 ft, which require a 16 ft (4.88 m) vertical clearance, could conceivably be on the reservoir. With 8.0 m of bridge clearance, and navigation speeds up to 16 km/h, these types of boats most likely to be on the reservoir would be accommodated, as well as houseboats up to 75 ft (clearance 7.27 m) and sailboats up to 14 ft in length.

- The clearance envelopes listed in Table 1 (Column J) are proposed as a minimum for navigation purposes for the bridge options at Lynx Creek, Farrell Creek, Halfway River and Cache Creek. In general a minimum clearance envelope of 8 m x 25 m is provided, however other design factors may lead to some bridges having clearances greater than the minimum. These clearance envelopes are subject to change based on on-going discussions with the British Columbia Ministry of Transportation and Infrastructure.

- At Dry Creek the reservoir will create a small area of inundation approximately 100 m x200 m behind the highway within what is presently a predominantly dry creek bed. The suitability of a bridge at this location (instead of a culvert as presently exists) will be reviewed in preliminary design with the British Columbia Ministry of Transportation

and Infrastructure, with consideration given to the requirement for navigation past the structure.

- While there may be some recreational value for smaller sail craft within the relatively confined areas of the upstream tributary arms, the need to provide access sailboats > 14 ft is not anticipated.

- While final locations for the bridges have not yet been determined, at least small embayments are created downstream of all bridge location options off the main reservoir. These will provide for boaters seeking refuge from the main reservoir without needing to pass under the bridge.

- River/creek classifications (Table 1 columns B and C) based on flow velocities which are to be confirmed will be provided when they come available for the existing rivers/creeks at bridge crossings, as well as for the river/creek portions which will be upstream of the embayments. These classifications will provide confirmation of the type of river/creek-going vessels which would need to be accommodated, however, it is not anticipated that the type of vessel expected to be navigating the embayment will be affected.

- Columns D, E, and F in Table 1 are provided as indicators of the sizes of the predominantly still-water embayments upstream of the bridges. These water bodies may be of interest to lake-going boats which may be larger than river/creek-going vessels.

- Column I in Table 1 notes the lengths of causeways that would be constructed on the approaches to the proposed bridges. These causeways would act as fingers of land that that would stretch into the embayments, and behind which would be protected bodies of water.

- Figure 1 includes pictures of types of vessels under consideration. Four houseboat photos are included as Figure 2, three of which are examples of large houseboats that could be accommodated under an 8 m clearance.

Next Steps

- BC Hydro will submit the Site C Clean Energy Project Environmental Impact Statement (EIS), with the bridge design and vessel clearances described in this memorandum included therein.

- BC Hydro will consider input received related to vessel clearances during the EIS review in preliminary design of the crossings.

- BC Hydro will seek Transport Canada's feedback on or approval of the Highway 29 Bridge clearance envelope requirements outlined in Table 1, in support of their review of the EIS or in support of any relevant regulatory authorizations under the *Navigable Waters Protection Act*.

Table 1 – Summary of Estimated Clearance Envelope Requirements

A	B	C	D	E	F	G	H	I	J	K
Bridge Site	**Existing River/Creek Classification at Bridge[1]**	**River/Creek Classification Upstream of Inundation[2]**	**Approx. Area of Inundation u/s of Bridge[3] (ha)**	**Approx. Width of Inundation at Bridge[3] (m)**	**Approx. Length of Inundation u/s of Bridge[3] (m)**	**Largest Motorized Boat Expected Under Bridge[4]**	**Largest Non-Motorized Boat Expected Under Bridge[4]**	**Bridge (B) and Causeway Approach (c) Lengths from Definition Design[5]**	**Estimated Required Navigation Clearance Envelope (at speed<16k/h)**	**Greater of Q_{100} Elevation[6] (Preliminary) or Maximum Normal Reservoir Level combined with Peace Canyon 5,278 m^3s discharge**
Lynx Creek			13	325	450	26 ft. propeller boat	14 ft. sailboat	B: 160 m C: 300 m	8 m x 25 m	462.1 m
Farrell Creek			56	250	2,300	32 ft. propeller boat	14 ft. sailboat	B: 170 m C: 180 m	8 m x 25 m	461.9 m
Halfway River			790	925	14,100	32 ft. propeller boat	14 ft. sailboat	B: 305 m C: 690 m	8 m x 25 m	461.8 m
Cache Creek			138	470	3,800	32 ft. propeller boat	14 ft. sailboat	B: 200 m C: 250 m	8 m x 25 m	461.8 m

Notes:

1. To be confirmed but it is not anticipated that river or creek classification will affect the type of boat reasonably expected to be navigating the waterbody at the bridge site.
2. To be confirmed but it is not anticipated that river or creek classification upstream of inundation will affect the type of boat reasonably expected to be navigating the river or creek.
3. Areas and distances are estimated from the Maximum Normal Reservoir Level, and are subject to change based on on-going discussions with the British Columbia Ministry of Transportation and Infrastructure regarding alignment and bridge options.
4. Boat classifications are from the Oregon State Marine Board Policy-Procedures Minimum Channel Clearance Guidelines for Recreational Boating and "*are the most likely vessels used on the generic class of waterway. Actual use may differ according to local regulations or conditions that limit use by certain types of boats*." Assuming flatwater, according to Oregon, propeller boats of 27' (8.23 m) to 40' (12.2 m) which require a 16' (4.88 m) clearance could conceivably be on the water. With 8.0 m of clearance at navigation speeds up to 16 km/h we should be able to accommodate the most likely types of boats to be expected on the Peace River reservoir including 75' (22.87 m) long houseboats with bridge clearance of 23'10" (7.27 m) with the exception of sailboats larger than 14' (4.27 m).
5. Lengths are subject to change throughout subsequent design stages. Length of causeway reflects the approximate length of earth fill as measured at full supply level along centreline of the proposed highway alignment.
6. Preliminary elevations provided by Klohn Crippen Berger. Revised elevations represent combination of Maximum Normal Reservoir Level (461.8 m) and 5,278 m^3s discharge from Peace Canyon Dam governing water level rather than Q_{100} or Q_{200} tributary flow at this stage.

Figure 1. Examples of types of boats under consideration.

26’ (7.93 m) Cruiser

30’ (9.15 m) Cruiser

20’ (6.1 m) Cruiser

20’ (6.1m) Water Taxi / Emergency Transport

14’ (4.27 m) Sailboat

14’ (4.27 m) Runabout

Figure 2. Examples of houseboats on Okanagan Lake

75’ (22.87 m) long Houseboat with 23’10” (7.27 m) bridge clearance

94’ (28.66m) long Houseboat with a bridge clearance of over 30’ (9.15 m)

66’ (20.12 m) long Houseboat with 20’6” (6.25 m) bridge clearance

55’6” (16.92 m) long Houseboat with 20’6” (6.25 m) bridge clearance

APPENDIX C

Part 6 Visual Resources Supporting Figures

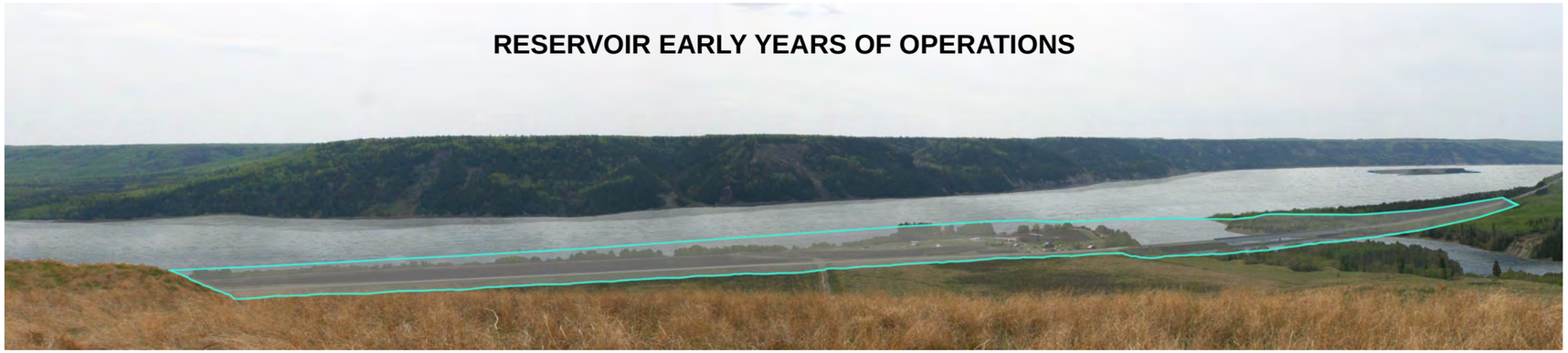
1 INTRODUCTION

This appendix includes panoramic images and visual simulations for the five selected receptor sites (Figures 1 – 5). For every site, baseline conditions, early years of operation and later years of operations are shown. The simulation of shoreline erosion during the early and later years of reservoir operations is supported by consideration of predicted shoreline erosion estimates after 5 (5-Year Beach Line) and 100 years (Erosion Impact Line) of reservoir operations. Refer to Section 11.2 Geology, Terrain, and Soils for further information regarding the reservoir impact lines. The purpose of this appendix is to support Section 27 Visual Resources of the Site C Clean Energy Project EIS.

Figures: Volume 3 Part 6

BASELINE

RESERVOIR EARLY YEARS OF OPERATIONS



LATER YEARS OF OPERATIONS

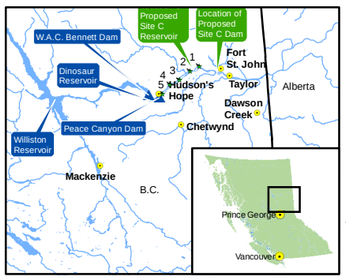
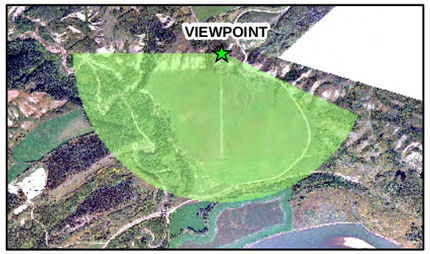


Figure Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Base Data: Province of B.C.
3. These artist renderings include a reasonable prediction of Project conditions during the operational phase. Changes from baseline conditions are only simulated where direct Project interaction is anticipated including reservoir inundation, shoreline erosion, and Highway 29 realignment.
4. The Reservoir Early Years of Operations rendering includes Highway 29 along a preferred realignment, however, the location is subject to change within the highlighted corridor, based on final design. The post-construction location of structures on Bear Flat properties will depend on the final Highway 29 alignment and confirmation of impact lines in relation to that final alignment as well as decisions made following discussions with the land owners.

VIEWPOINT LOCATION



SITE DETAILS

VIEWPOINT	4
EASTING	609732.39370
NORTHING	6239206.80510
ELEVATION (M)	599
DATE	05/15/12
TIME	12:10:26
WEATHER CONDITIONS	CLOUDY
FOCAL LENGTH (MM)	28.8
FIELD OF VIEW	155
HIEGHT OF CAMERA ABOVE GROUND (M)	1.6

LEGEND

Highway 29 Realignment Corridor (See Notes)

SITE C CLEAN ENERGY PROJECT

BC hydro | Golder Associates

Figure 1
Receptor Site 1 Highway 29, overlooking Bear Flat - baseline, early and later years of operations

Date	Dec. 18, 2012

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification

BASELINE

RESERVOIR EARLY YEARS OF OPERATIONS

LATER YEARS OF OPERATIONS

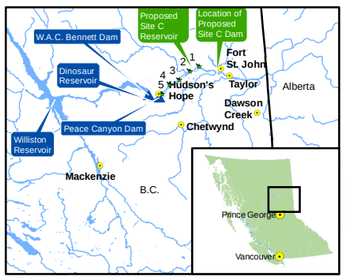
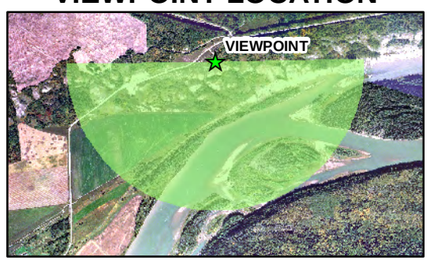


Figure Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Base Data: Province of B.C.
3. These artist renderings include a reasonable prediction of Project conditions during the operational phase. Changes from baseline conditions are only simulated where direct Project interaction is anticipated including reservoir inundation, shoreline erosion, and Highway 29 realignment.

VIEWPOINT LOCATION



SITE DETAILS

VIEWPOINT	5
EASTING	598972.79910
NORTHING	6233907.44780
ELEVATION (M)	636
DATE	05/15/12
TIME	12:32:16
WEATHER CONDITIONS	CLOUDY
FOCAL LENGTH (MM)	28.8
FIELD OF VIEW	180
HIEGHT OF CAMERA ABOVE GROUND (M)	1.6

SITE C CLEAN ENERGY PROJECT

BC hydro · Golder Associates

Figure 2
Receptor Site 2 Highway 29, overlooking Attachie - baseline, early and later years of operations

Date	Dec. 18, 2012			

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification

BASELINE

RESERVOIR EARLY YEARS OF OPERATIONS

LATER YEARS OF OPERATIONS

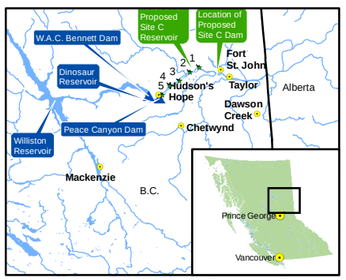
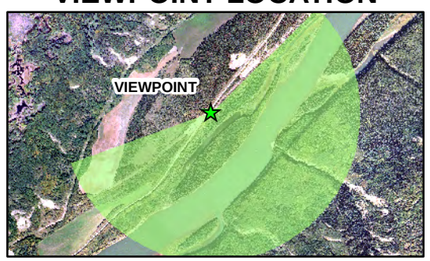


Figure Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Base Data: Province of B.C.
3. These artist renderings include a reasonable prediction of Project conditions during the operational phase. Changes from baseline conditions are only simulated where direct Project interaction is anticipated including reservoir inundation, shoreline erosion, and Highway 29 realignment.

VIEWPOINT LOCATION



SITE DETAILS

VIEWPOINT	8
EASTING	586559.27790
NORTHING	6224175.33640
ELEVATION (M)	508
DATE	05/15/12
TIME	13:09:13
WEATHER CONDITIONS	CLOUDY
FOCAL LENGTH (MM)	28.8
FIELD OF VIEW	205
HIEGHT OF CAMERA ABOVE GROUND (M)	1.6

SITE C CLEAN ENERGY PROJECT

BC hydro · Golder Associates

Figure 3
Receptor Site 3 Highway 29, east of Farrell Creek - baseline, early and later years of operations

Date	Dec. 18, 2012			

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification

BASELINE

RESERVOIR EARLY YEARS OF OPERATIONS

LATER YEARS OF OPERATIONS

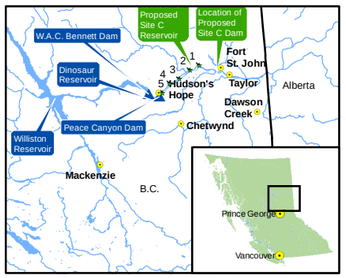
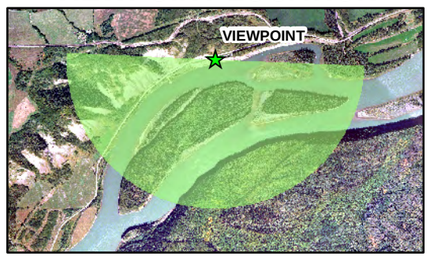


Figure Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Base Data: Province of B.C.
3. These artist renderings include a reasonable prediction of Project conditions during the operational phase. Changes from baseline conditions are only simulated where direct Project interaction is anticipated including reservoir inundation, shoreline erosion, and Highway 29 realignment.

VIEWPOINT LOCATION



SITE DETAILS

VIEWPOINT	9
EASTING	575181.75840
NORTHING	6219510.75090
ELEVATION (M)	496
DATE	05/15/12
TIME	13:24:21
WEATHER CONDITIONS	CLOUDY
FOCAL LENGTH (MM)	28.8
FIELD OF VIEW	180
HIEGHT OF CAMERA ABOVE GROUND (M)	1.6

SITE C CLEAN ENERGY PROJECT

BC hydro | Golder Associates

Figure 4
Receptor Site 4 Highway 29, west of Farrell Creek Bridge - baseline, early and later years of operations

Date	Dec. 18, 2012			

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification

BASELINE

RESERVOIR EARLY YEARS OF OPERATIONS

LATER YEARS OF OPERATIONS

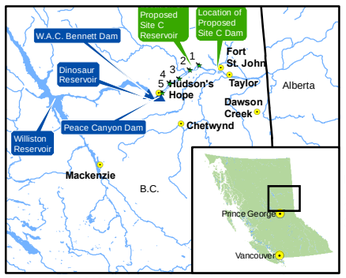
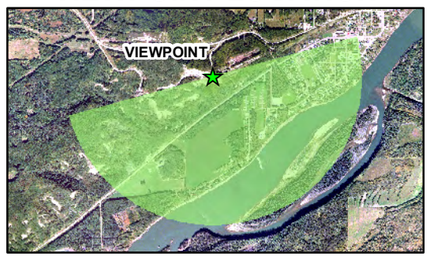


Figure Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Base Data: Province of B.C.
3. These artist renderings include a reasonable prediction of Project conditions during the operational phase. Changes from baseline conditions are only simulated where direct Project interaction is anticipated including reservoir inundation, shoreline erosion, and Highway 29 realignment.

VIEWPOINT LOCATION



SITE DETAILS

VIEWPOINT	10
EASTING	566285.23160
NORTHING	6209341.04770
ELEVATION (M)	609
DATE	05/15/12
TIME	13:54:23
WEATHER CONDITIONS	CLOUDY
FOCAL LENGTH (MM)	28.8
FIELD OF VIEW	180
HIEGHT OF CAMERA ABOVE GROUND (M)	1.6

SITE C CLEAN ENERGY PROJECT

BC hydro · Golder Associates

Figure 5
Receptor Site 5 Hudson's Hope, Canyon Drive - baseline, early and later years of operations

Date	Dec. 18, 2012			

Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification