

SITE C CLEAN ENERGY PROJECT HUDSON'S HOPE BERM OPTIONS

Consultation Brief – Fall 2011
October 14, 2011

SITE C CLEAN ENERGY PROJECT – STAGE 3 CONSULTATION OPPORTUNITIES

Stage 3 of the Site C Clean Energy Project is the environmental and regulatory review stage with a thorough and independent environmental assessment process. This stage will include opportunities for consultation and input by the public, Aboriginal groups, communities, property owners and stakeholders.

In addition to the consultation opportunities led by the environmental regulatory agencies within the environmental assessment process, BC Hydro will lead several streams of public and stakeholder consultation during Stage 3. These consultation streams are outlined below.

In addition, BC Hydro and Aboriginal groups are engaged in a thorough consultation process that will continue through all stages of the project.

REGIONAL AND LOCAL GOVERNMENT LIAISON

BC Hydro is engaging key municipal, regional and provincial government stakeholders to ensure they are kept up to date on the status of the project, and are consulted on key issues, particularly those that are directly related to local governments.

There are two components of Regional and Local Government Liaison: the Regional and Local Government Liaison committee brings together regional Mayors and Directors of the Peace River Regional District with the Site C project team, while Local Government Technical Engagement allows key municipal staff to meet with Site C project staff on a community-by-community basis.

PROPERTY OWNER LIAISON

Following up on property owner consultation held in Stage 2, group property owner meetings, individual meetings and two-way information sharing with property owners is continuing throughout Stage 3.

LOCAL AREA CONSULTATION

BC Hydro will conduct specific consultations with communities on issues of local and community interest as issues arise. The consultation on Hudson's Hope Berm Options that is in fall 2011 is an example of a Local Area Consultation and will include consultation with local government, property owners and the community by way of public open houses.

PRELIMINARY DESIGN CONSULTATION

Building on the public and stakeholder consultation conducted in Stage 2, Preliminary Design Consultation in Stage 3 in 2012 will be a broad consultation focused on gathering stakeholder and public input on a range of topics important to project planning and environmental assessment.

ENVIRONMENTAL ASSESSMENT

In September 2011, the federal and provincial governments released a draft agreement for a harmonized environmental review of the Site C project. The draft agreement includes a joint review panel process for Site C, and initiates the environmental assessment.

The Canadian Environmental Assessment Agency (CEA Agency) and the B.C. Environmental Assessment Office (EAO) are inviting public comments until November 7, 2011, on the draft agreement to conduct a harmonized environmental assessment, including the establishment of a joint review panel.

For more information on the environmental assessment process for Site C and to find out how to submit comments to the CEA Agency or the EAO, go to:

- British Columbia Environmental Assessment Office: www.eao.gov.bc.ca
- Canadian Environmental Assessment Agency: www.ceaa-acee.gc.ca

There will be multiple opportunities for input by the public, Aboriginal groups, communities, property owners and stakeholders within the environmental assessment process.

HOW INPUT WILL BE USED

As the project moves forward through this regulatory review stage, your input will help inform the project team's planning processes, the project definition and plans for mitigation of potential project impacts as BC Hydro prepares the Environmental Impact Statement for review in the environment assessment process.

A Consultation Summary Report will be prepared and released on the project website following each consultation period and Consideration Memos will be prepared, indicating how input has been considered, along with technical and financial information, for use in project designs or plans, including engineering and environmental mitigation plans.

PURPOSE OF THIS CONSULTATION BRIEF

This consultation brief outlines topics for discussion with the District of Hudson’s Hope, property owners and the community regarding the Hudson’s Hope berm, including:

- Options for the Hudson’s Hope berm
- Potential public use options for berm areas, including:
- Public access to berm areas
- Potential landscaping and recreation opportunities in berm areas

Input received will be considered, along with technical and financial information, as BC Hydro refines the design of the Hudson’s Hope berm. Additional opportunities for public input regarding the berm and draft mitigation plans will occur during the environmental and regulatory review public comment periods.

Public and Stakeholder Feedback Deadline: November 30, 2011

FIRST NATIONS CONSULTATION

This brief will be provided as information to First Nations. Consultation with First Nations regarding the Hudson’s Hope berm options may also be undertaken, as appropriate.

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1. SITE C CLEAN ENERGY PROJECT

The Site C Clean Energy Project (Site C) is being proposed as part of BC Hydro's overall program to invest in and renew the province's electricity system.

Site C is a proposed third dam and hydroelectric generating station on the Peace River in northeast B.C. It would provide up to 1,100 megawatts (MW) of capacity, and produce about 5,100 gigawatt hours (GWh) of electricity each year — enough energy to power more than 450,000 homes per year in B.C.

The Site C reservoir would be approximately 83 kilometres long and would be, on average, two to three times the width of the current river. The Site C reservoir would be one of the most stable in the BC Hydro system with relatively little fluctuation in water levels during typical operations.

The Site C project requires environmental certification and other regulatory permits and approvals before it can proceed to construction. In addition, the Crown has a duty to consult and, where appropriate, accommodate Aboriginal groups.

If approved, Site C would be a source of clean and renewable electricity in B.C. for over 100 years. It would be a publicly owned heritage asset for the benefit of all British Columbians.

2. HUDSON'S HOPE BERM – OVERVIEW

The slopes below Hudson's Hope comprise erodible sand, silt and clay overburden material and more resistant bedrock. Flooding of the Site C reservoir would result in a change in the groundwater conditions that, when coupled with the effects of shoreline erosion, is predicted to cause some bank recession in the sand, silt and clay slopes. As a result, a 1,360-metre long berm was proposed as part of the 1980s Site C project design to protect the residential portions of the shoreline. Preliminary results of more recent Stage 2 studies verified that parts of the shoreline at Hudson's Hope have potential to erode. For that reason, BC Hydro has reiterated its commitment to providing a berm at Hudson's Hope.

In Stage 3, the environmental and regulatory review stage, BC Hydro commissioned an update of the 1980s berm design for present conditions, as part of work on assessing the potential impacts of the Site C reservoir. Since the 1980s, additional development (i.e., the hotel) has occurred just to the east of where the 1980s berm design ended. As a result, the updated design for the berm has been extended approximately 300 metres to the east to protect this additional development, as well as long-term maintenance access to the berm from D. A. Thomas Road. In addition to the area protected by the 1980s berm, consideration has also been given to a berm option that protects the shoreline area to the east, including the municipal sewage lagoons.

THREE BERM OPTIONS FOR DISCUSSION

Three berm options are summarized in this document. BC Hydro is consulting the District of Hudson's Hope, potentially directly affected property owners, and the community of Hudson's Hope regarding the berm options, potential public access to the berm areas, and potential landscaping/recreation opportunities. Input received through consultation will be considered, along with technical and financial information, as BC Hydro determines which berm option to include in the application for an Environmental Assessment Certificate.

Site C is subject to regulatory approvals and environmental certification. As the project moves forward through this regulatory review stage, your input into these preliminary plans will help inform the project team's planning processes and the project definition. Your input will support plans for mitigation, transportation and reclamation options as we prepare the Application for Environmental Assessment. Public comment periods on these mitigation plans will be part of the environmental review process.

3. BACKGROUND

3.1 CURRENT CONDITIONS

The slopes below Hudson’s Hope comprise erodible sand, silt and clay material and more resistant bedrock. The sand, silt and clay slopes experience *natural processes* that consist of river erosion at the toe (bottom) of the slope, and ongoing shallow landslides from the mid to upper slopes. It is estimated that the river erosion rates have been somewhat reduced by the construction of the W.A.C. Bennett and Peace Canyon Dams upstream, which have reduced peak flows of the Peace River during spring freshet.

According to its Official Community Plan, the District of Hudson’s Hope identifies lands located on steep slopes (steeper than 30% or 17 degrees) as well as land within 15 metres of the crest of these slopes as “potentially hazardous”. According to the Official Community Plan, future development in these areas is discouraged, and will not be permitted without a geotechnical assessment.

Without a berm, the Site C reservoir is expected to affect the stability of the sand, silt and clay slopes below Hudson’s Hope. Rates of toe erosion by wind-generated waves as well as the likelihood of landslides would be expected to increase.

As such, a berm is being proposed and would be designed to protect the shoreline from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability, thereby maintaining or improving the stability of the slopes compared to their historical performance.

The potential for future landslides on the mid to upper slopes caused by *natural processes* would not be eliminated, however, likely requiring that Hudson’s Hope continue to enforce setback limits from the top of the slope above the berm for future land use planning.

3.2 IMPACT LINES APPROACH

During Stage 2 consultation with the community, stakeholders and the public, BC Hydro introduced an impact lines-based approach to assess the potential effects of the proposed Site C reservoir on the reservoir slopes. The purpose of the impact lines approach is to:

- Ensure safety
- Maximize land use flexibility
- Minimize the amount of land required for the project

Areas of interest have been identified that are potentially affected by flooding, slope stability, erosion, changes in groundwater levels, and landslide-generated waves. To date, this work has been completed through historical knowledge of the ground conditions in the region, with limited site-specific assessment. Further geological mapping and subsurface investigations are underway to develop and refine the position of the impact lines, with emphasis on locations where there are residences, municipal infrastructure and sections of Highway 29 that might be affected.

3.3 GEOTECHNICAL INVESTIGATIONS

To gather more information about shoreline conditions, BC Hydro began a series of geotechnical investigations along the proposed reservoir slopes in April 2011. This program consists of surface inspections, subsurface investigations, and the installation and monitoring of geotechnical instruments on both private and Crown land.

Information from these geotechnical investigations is being used to conduct modelling of erosion and slope stability, which will allow BC Hydro to develop and refine the location of the impact lines and to make recommendations for berm options at Hudson’s Hope and for future land use planning. This information will be available for public review once complete, and will be included as part of the environmental assessment application.

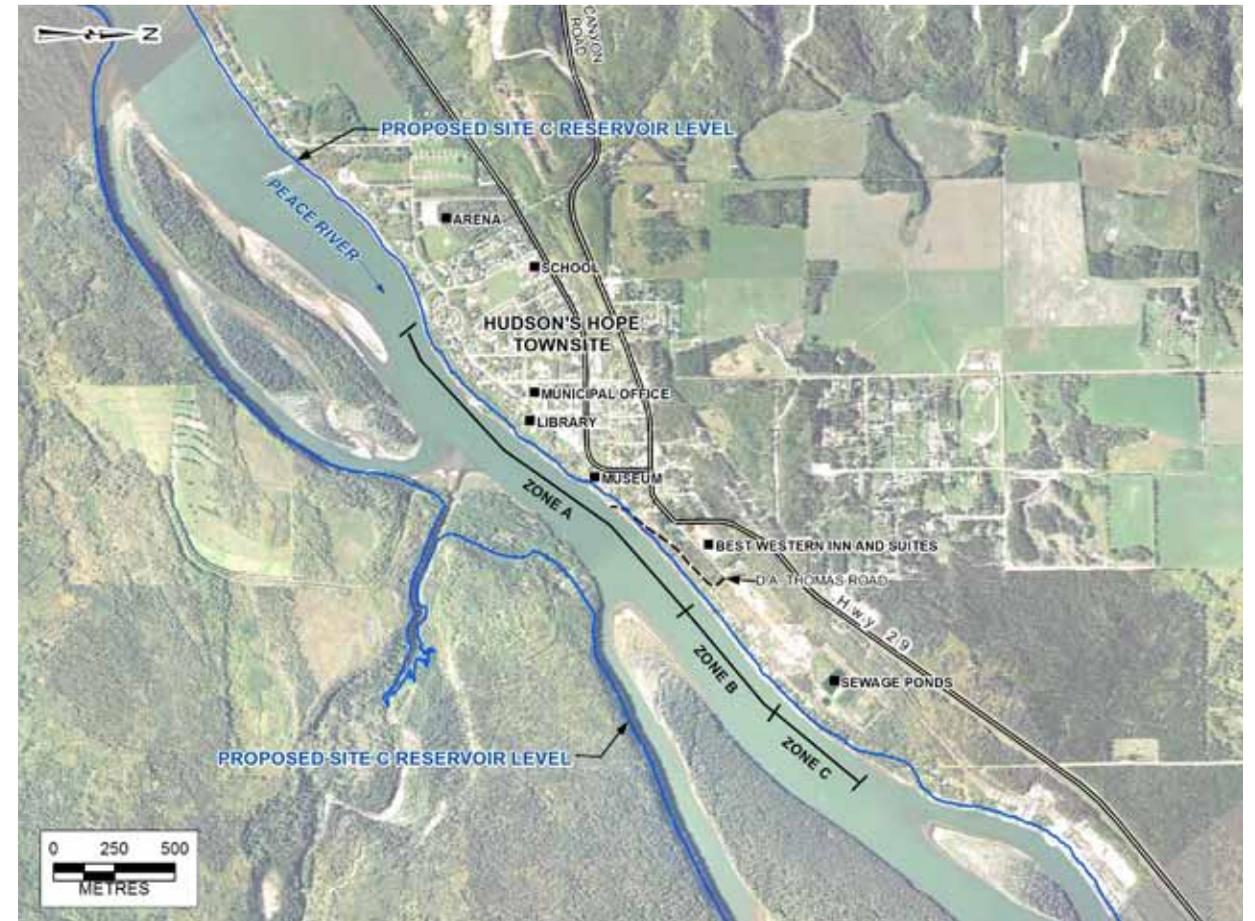
4. HUDSON'S HOPE BERM

4.1 BERM ZONES

In developing options for a berm, the Hudson's Hope shoreline was divided into three zones, with the following land uses and lengths. The land in all three zones currently has potential for erosion.

The three shoreline zones are denoted in the map on the next page.

Zone	Geological Description	Current Land Use Description	Length
A	Overburden slopes – interbedded sand, silt and clays.	Residential area. Zone A is based on the historical length of the berm, with an additional 300 metres downstream (east) added to include additional commercial development since the 1980s berm design.	1,650 metres
B		Undeveloped land zoned as light industrial. Currently used for industrial use and gravel pit.	550 metres
C		Municipal sewage pond facility.	450 metres



This map illustrates the length of the berm option zones along the Hudson's Hope shoreline.

4. HUDSON'S HOPE BERM ...CONTINUED

4.2 BERM OPTIONS FOR DISCUSSION

BC Hydro is presenting three berm options for discussion. They are summarized in the following table:

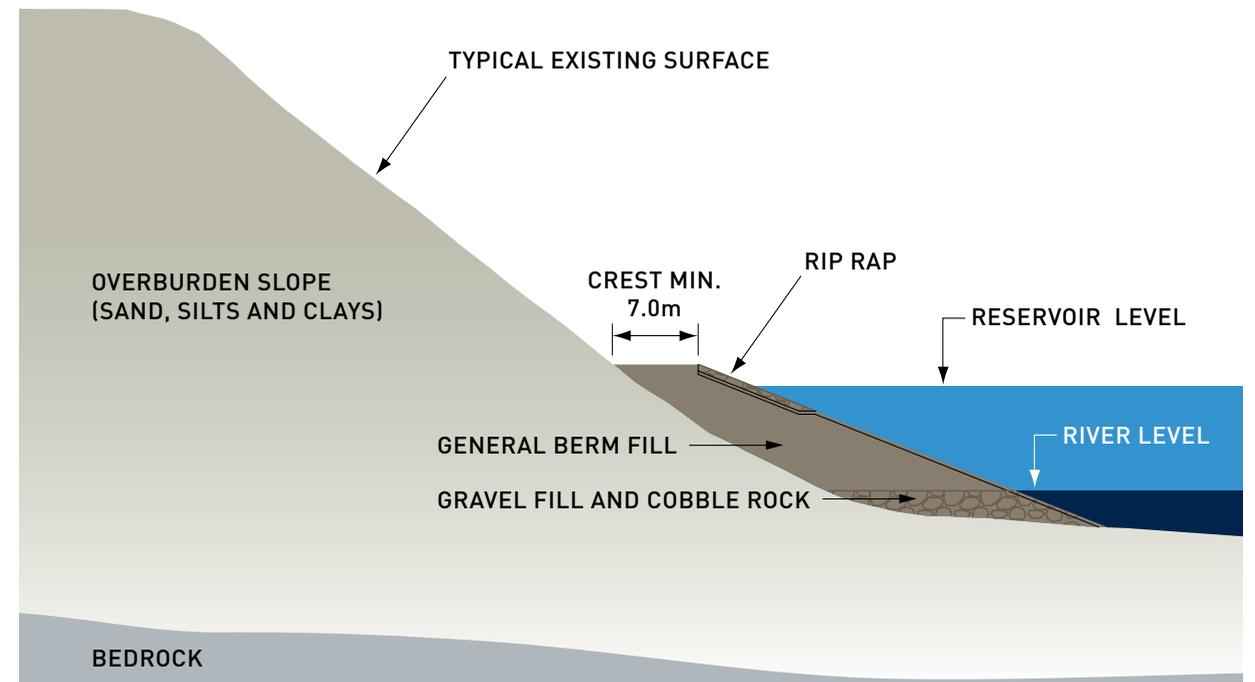
Option	Description	Length of Berm/Protection	Considerations
1	Zone A berm	1,650 metres	Berm in front of residential land, as well as new commercial development since the 1980s berm design.
2	Zone A and C berm	2,100 metres	Berm in front of residential land, new commercial development since the 1980s berm design, as well as municipal sewage ponds.
3	Zone A and C berm, slope flattening in Zone B	2,650 metres	Berm in front of residential land, new commercial development since the 1980s berm design, as well as land zoned as light industrial and municipal sewage ponds. Materials taken from Zone B could be used as construction materials for the berm in Zones A and C.

The berm would be designed to protect the shoreline from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability, thereby maintaining or improving the stability of the slopes compared to their current condition.

Based on preliminary engineering, the berm would be built with gravel fill, cobble rock, and rip rap, and would be located at the bottom of the slope. It would have a minimum crest width of approximately 7 metres. The diagram to the right shows a typical cross-section of the berm in relation to the current river, the Site C reservoir, and the existing slope.

CONSTRUCTION TIMING AND MATERIALS

Construction for the overall Site C Clean Energy Project is expected to take approximately seven years. It is anticipated that construction of the Hudson's Hope Berm would start in year two or three, and would require approximately two construction seasons (between spring and fall for two years) to complete. Construction works for the Hudson's Hope Berm would primarily involve the sourcing and placement of the gravel fill, cobble rock and rip rap materials



Representative cross-section of the Hudson's Hope berm.

along the shoreline. For Option 3, it would also include excavating the bank in Zone B and transporting the material to build the berm in Zones A and C.

The duration of construction will be influenced by how much material needs to be placed, and the sources of construction materials. The berm would be constructed from several different materials including gravel fill, cobble rock base, and rip-rap protection. Each of these materials will likely be sourced from different locations and hauled to the site by truck.

The current assumption is that the majority of the gravel fill would be sourced from adjacent islands in the Peace River, which would be cleared and flooded during reservoir filling, reducing the requirement to transport materials from other locations. BC Hydro is currently investigating the feasibility of sourcing the gravel fill from these islands.

4. HUDSON'S HOPE BERM ...CONTINUED

4.3 OPTION 1 – BERM IN ZONE A ONLY

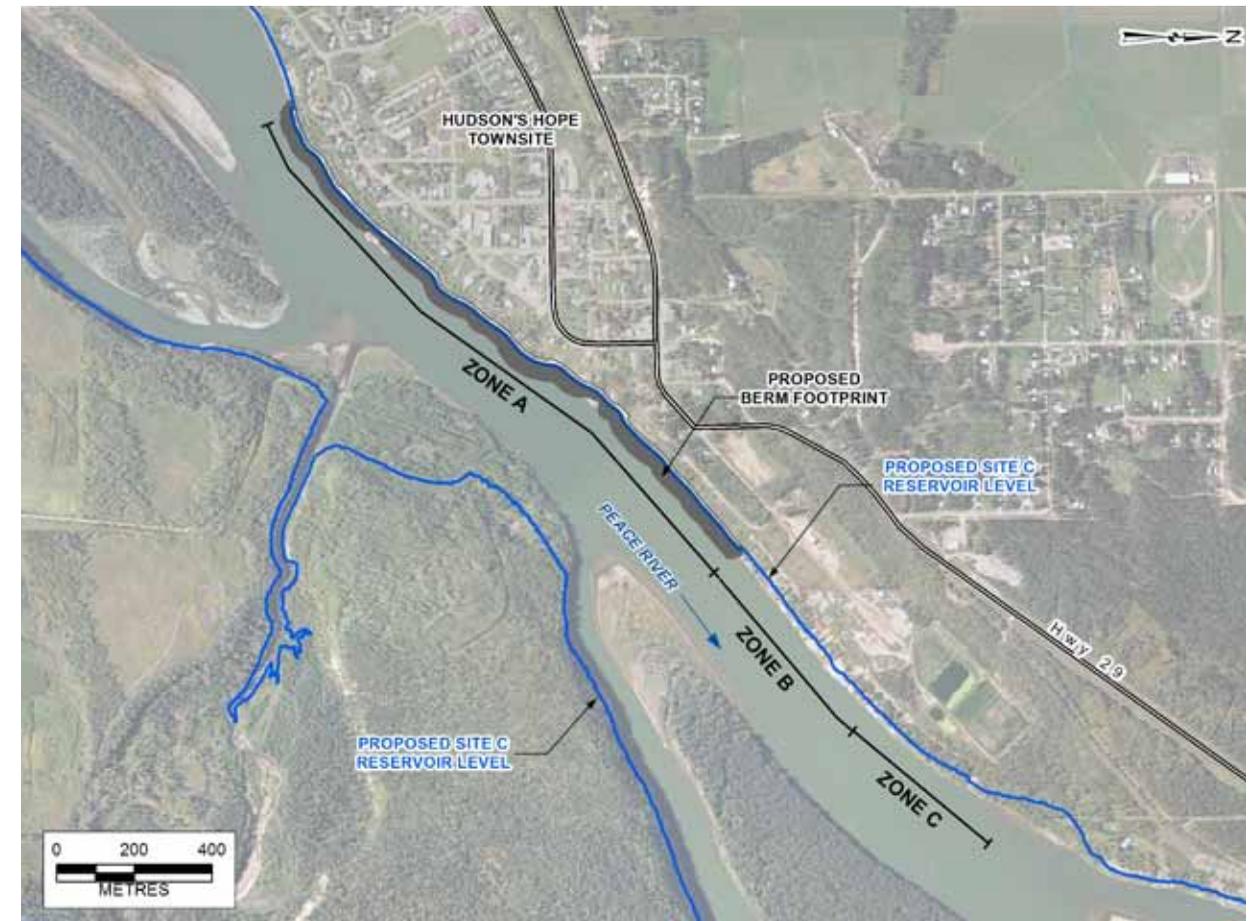
BERM LENGTH:

In Option 1, a berm would be constructed in front of Zone A. When the Site C project was contemplated in the 1980s, the historic proposed berm design was 1,360 metres long, and protected the shoreline in front of residential properties. Through its Stage 3 technical work, BC Hydro proposed an extension to the berm of approximately 300 metres to the east to reflect additional community development that has occurred in the community (i.e., the hotel). This option would provide protection along 1,650 metres of shoreline.

CONSIDERATIONS:

The land in Zone A, upon which the berm would be constructed, includes privately owned shoreline residential property, municipal land, and BC Hydro-owned land fronting privately owned residential parcels. Also, there are access roads, owned by the District of Hudson's Hope, running down to the river.

The berm in Zone A would be designed to protect the residential properties from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability, thereby maintaining or improving the stability of the slopes compared to their current condition. The potential for future landslides from the upper slopes that currently exists due to *natural processes* would not be eliminated. Therefore, it is anticipated that Hudson's Hope would continue its current approach of enforcing setback limits from the top of the slope above the berm for future land use planning.



Hudson's Hope Berm Option 1 (Berm in Zone A): A 1,650-metre berm would be constructed in front of residential properties and commercial development.

4. HUDSON'S HOPE BERM ...CONTINUED

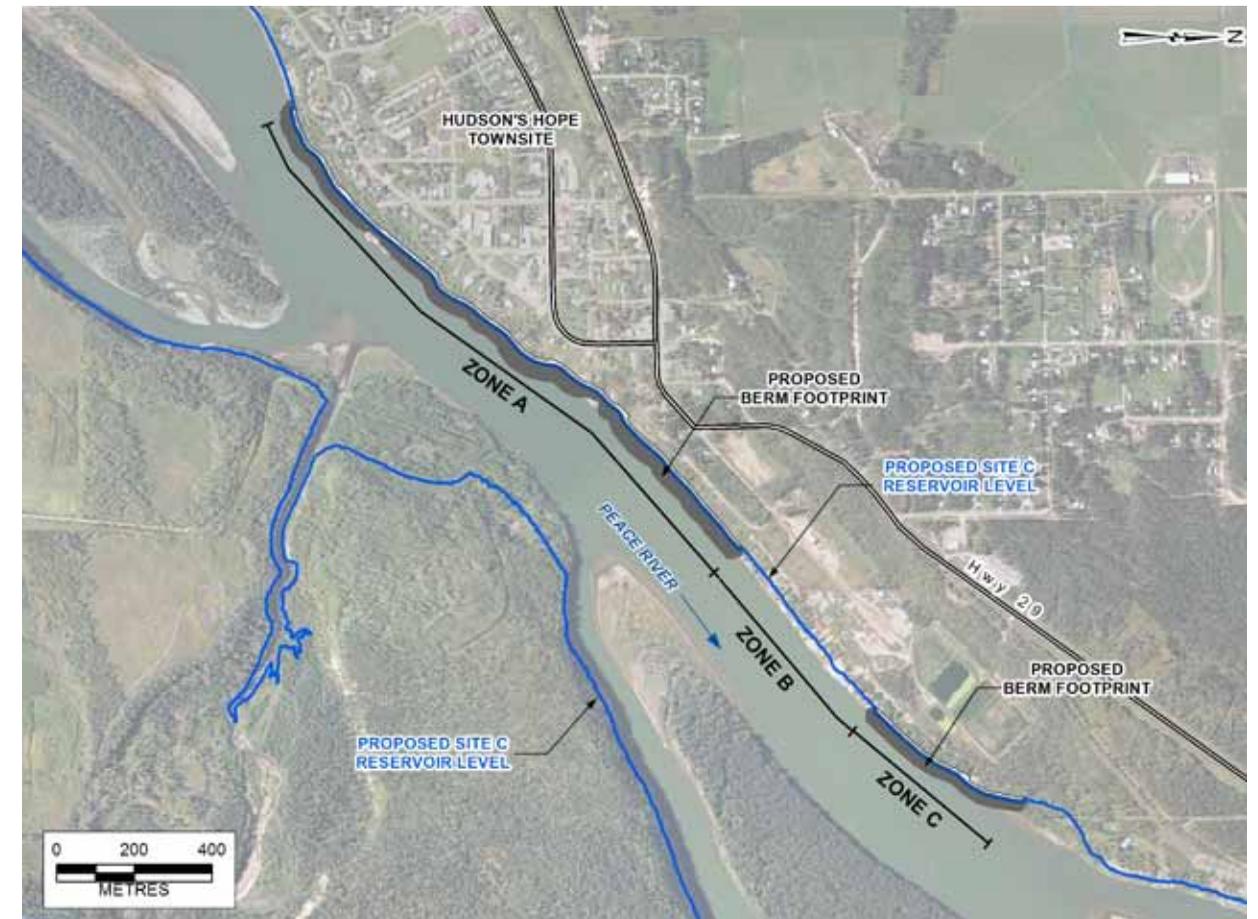
4.4 OPTION 2 – BERM IN ZONE A AND ZONE C

BERM LENGTH:

Option 2 provides the same berm in front of residential properties in Zone A, and provides an additional 450- metre-long berm below the existing municipal sewage lagoons in Zone C. This option would provide protection along 2,100 metres of shoreline.

CONSIDERATIONS:

Zone C includes a combination of privately owned and Crown land and is zoned light industrial. The berm in Zones A and C would be designed to protect the residential properties and sewage lagoons from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability, thereby maintaining or improving the stability of the slopes compared to their historical performance. The potential for future landslides from the upper slopes that currently exists due to *natural processes* would not be eliminated. Therefore, it is anticipated that Hudson's Hope would continue its current approach of enforcing setback limits from the top of the slope above the berm for future land use planning.



Hudson's Hope Berm Option 2 (Berm in Zone A and Zone C): Provides a berm in front of residential properties and commercial development in Zone A, but also provides a berm below the existing municipal sewage lagoons in Zone C.

4. HUDSON'S HOPE BERM ...CONTINUED

4.5 OPTION 3 – BERM IN ZONE A AND ZONE C, SLOPE FLATTENING IN ZONE B

BERM LENGTH:

Option 3 provides a berm in Zones A and C, and flattens the slope to mitigate erosion and landslide hazards in Zone B. It is anticipated that the majority of materials excavated in the flattening process in Zone B could be used in the construction of the berm in Zone A or Zone C. This option would provide protection along 2,650 metres of shoreline.

CONSIDERATIONS:

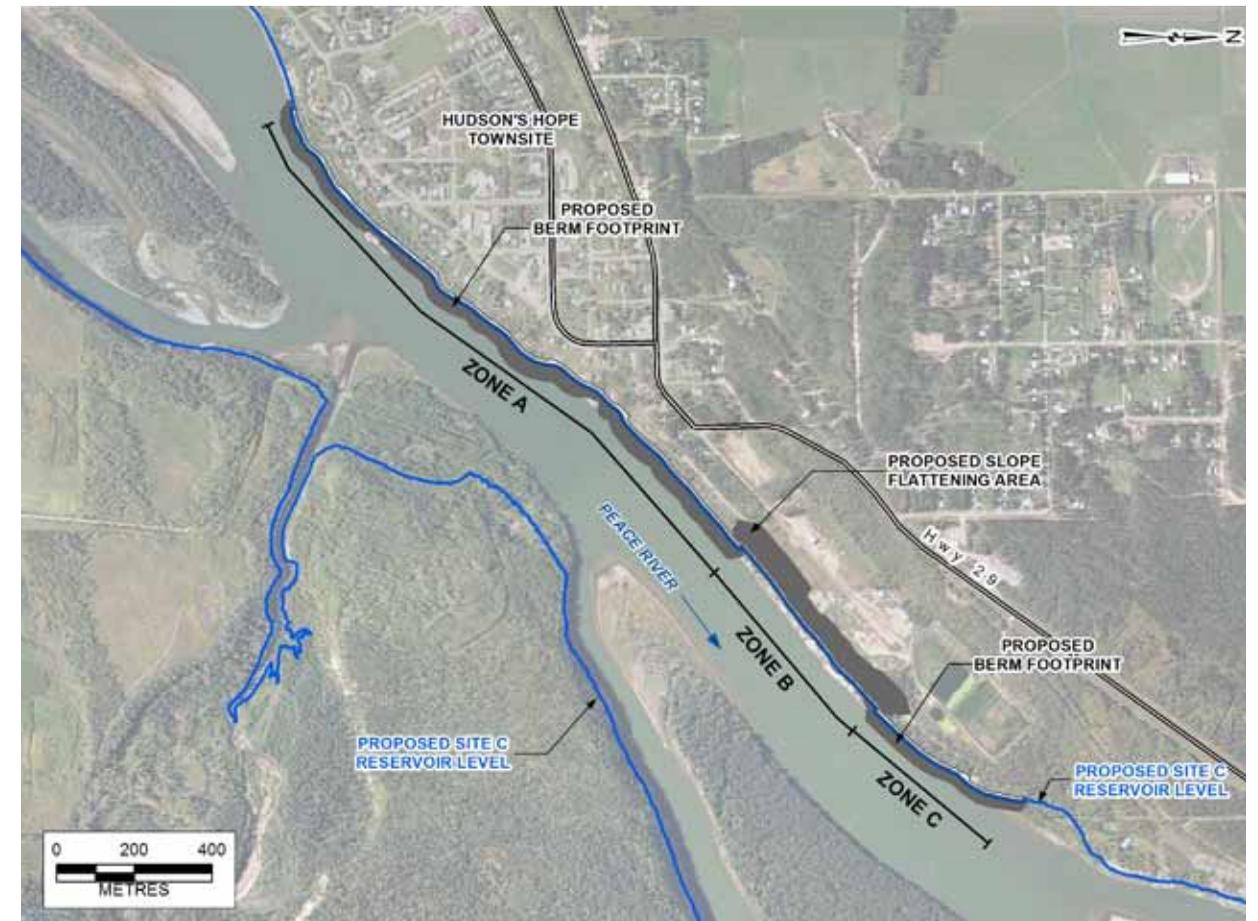
The berm in Zones A and C would be designed to protect the residential properties from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability, thereby maintaining or improving the stability of the slopes compared to their current condition. The potential for future landslides from the upper slopes that currently exists due to *natural processes* would not be eliminated. Therefore, it is anticipated that Hudson's Hope would continue its current approach of enforcing setback limits from the top of the slope above the berm for future land use planning.

Zone B includes privately owned land, Crown land and municipal land with significant development potential if it is rezoned. Currently, it is zoned industrial and designated in the Hudson's Hope Official Community Plan as a strip of park land along the shoreline with industrial land behind the crest of the slope. It is currently used for industrial storage and as a gravel pit.

The slope flattening in Zone B would extend back approximately 28 metres from the top crest of the current slope and would be designed to protect the lands above it from the effects of erosion from the reservoir, and to offset the effects of the reservoir on slope stability. The slope would be excavated to a stable angle to minimize the potential for future landslides. Rock rip rap would be placed at the toe of the slope to prevent erosion. Consequently, minimal setback from the top of this engineered slope would be required for future development planning.

The flattening of the slope would allow for an opportunity to provide better pedestrian access to the shoreline.

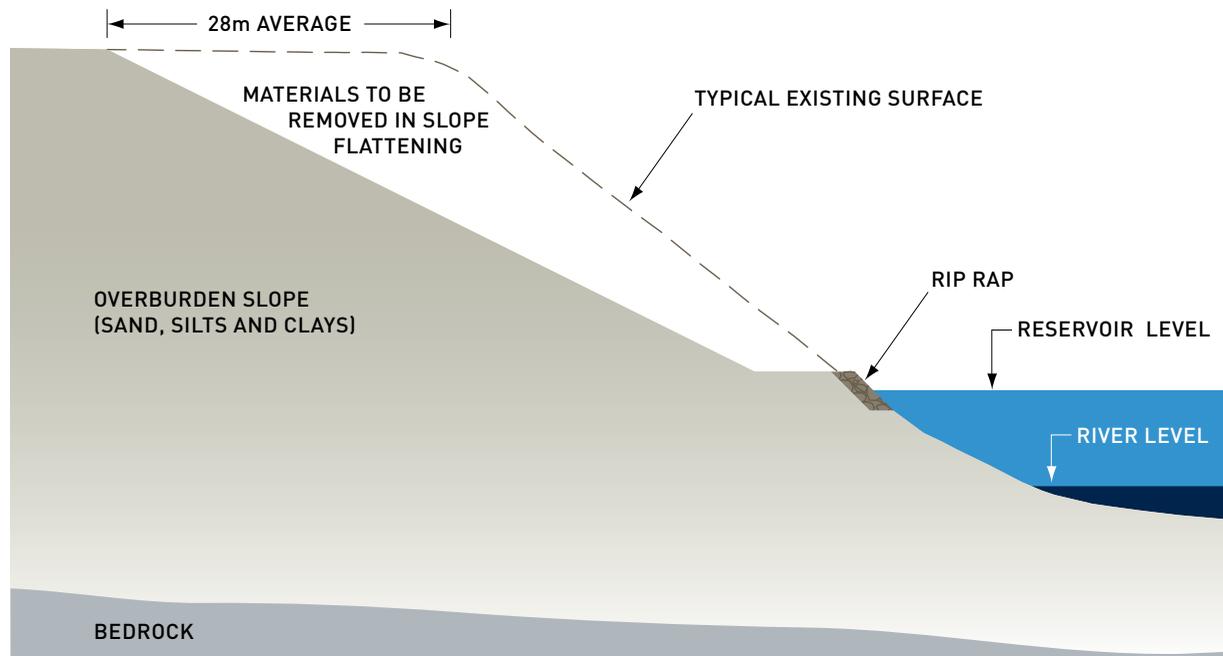
Use of materials excavated from Zone B in the construction of the berm in Zone A or Zone C would reduce the length of the construction period, and could also reduce the number of trucks on public roads bringing materials in to the construction site.



Hudson's Hope Berm Option 3 (Berm in Zone A and Zone C, Slope Flattening in Zone B): Provides a berm in front of residential properties and commercial development in Zone A and below the existing municipal sewage lagoons in Zone C, and also flattens the slope to mitigate erosion and landslide hazards in Zone B.

4. HUDSON'S HOPE BERM ...CONTINUED

The following diagram shows a typical cross-section of the slope flattening in relation to the current river, the Site C reservoir and the existing slope. The slope-flattening geometry can be varied to accommodate various potential landscaped and recreational uses.



Representative cross-section of the Zone B slope flattening.

5. PUBLIC USE OPTIONS

There may be opportunities for public use in the berm areas (Zones A and C) and the slope-flattened area (Zone B).

While these opportunities are subject to agency consultation and regulatory review, BC Hydro is seeking early input from local government, property owners and the community of Hudson's Hope regarding potential public use and recreation options. BC Hydro is particularly interested in feedback from the community regarding potential options for access, landscaping approaches and recreational amenities.

5.1 PUBLIC ACCESS TO BERM IN ZONE A

The properties above Zone A do not currently allow for public access to the Peace River shoreline in that area. BC Hydro is interested in whether property owners and residents would prefer no public access to continue after the construction of the berm, or whether they would be interested in allowing public access to the berm area.

Alternatively, public access could be provided **east** of the old ferry landing at the bottom of D.A. Thomas Road. Depending on which berm option is chosen, recreation access could continue into Zones B and C.

5. PUBLIC USE OPTIONS

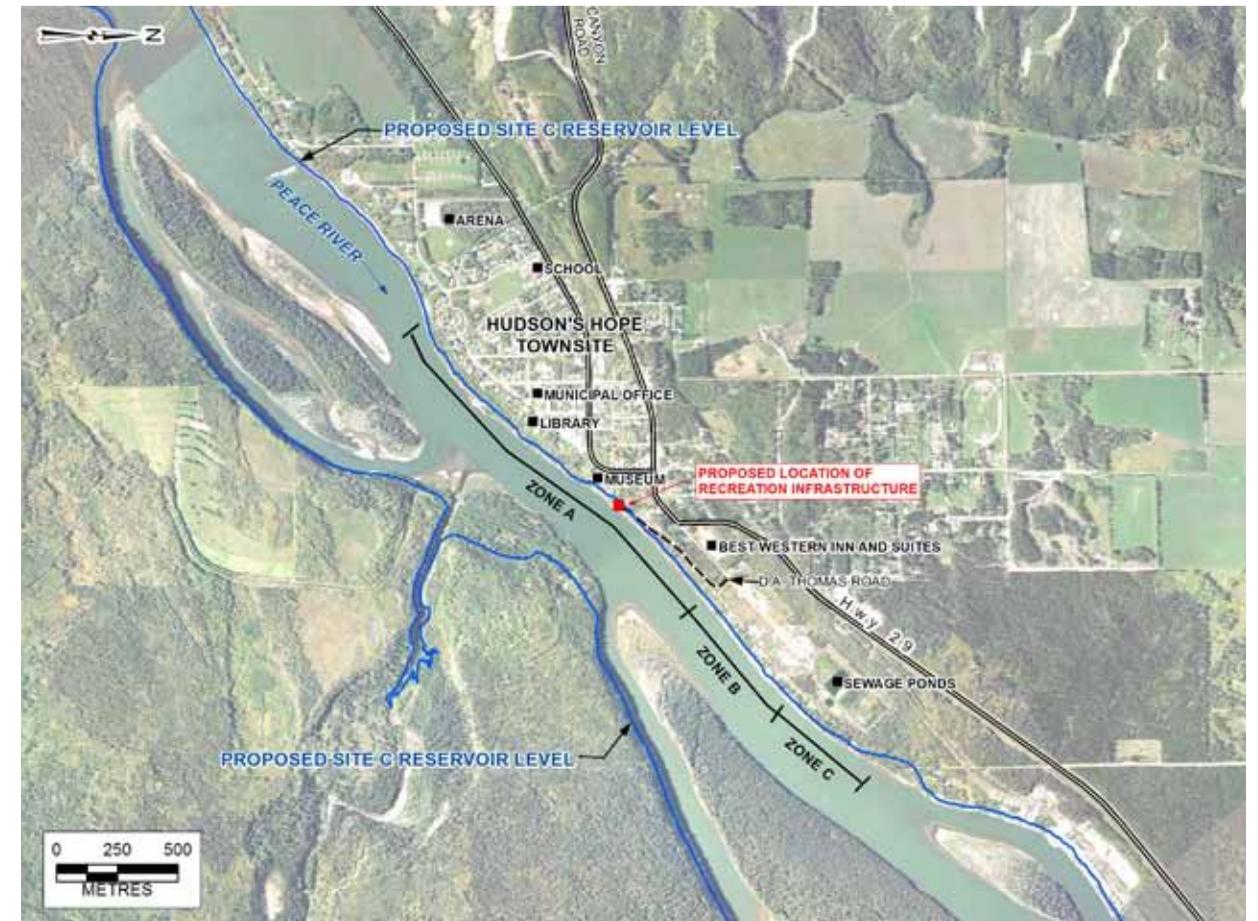
5.2 LANDSCAPING AND RECREATIONAL AMENITY OPTIONS

One of the design objectives for the berm is to make it visually compatible with the natural landscape by adding cover soil and vegetation to the sides and top of the berm.

BC Hydro would like to learn about the community's interest in additional landscaping and recreational amenities, which could include one of the following concepts:

- **Landscaped, no recreation use** – This concept proposes a berm with a natural appearance, with the use of cover soil and native plants. Access to the shoreline would be similar to current access.
- **Landscaped, basic recreation use** – In addition to native plant landscaping, this concept could include a gravel walking path, with benches or picnic tables along the walkway.
- **Landscaped, enhanced recreation infrastructure** – In addition to plantings, this concept could include a hard-surface (asphalt) walking path, benches or picnic tables, and structures such as washrooms, a small-craft boat launch, a foot trail to town, or other recreational facilities that may be identified by the community.

The map to the right illustrates the potential location of the recreational access, generally in the area of the existing car top access area.



This map illustrates the potential location of recreation access and infrastructure.

HOW INPUT WILL BE USED

Input received will be considered, along with technical and financial information, as BC Hydro refines the design of the Hudson's Hope Berm.

Public and Stakeholder Feedback Deadline: November 30, 2011

CONTACT INFORMATION:

Please provide your contact information (optional):

Name:

Mailing Address:

Postal Code:

Phone:

Email:

Consent to Use Personal Information

I consent to the use of my personal information by BC Hydro for the purpose of contacting me and keeping me updated about the potential Site C Clean Energy Project.

For purposes of the above, "my personal information" includes name, mailing address, phone number and email address, as per the information I provide.

Signature:

Date:

Any personal information you provide to BC Hydro on this form is collected and protected in accordance with the **Freedom of Information and Protection of Privacy Act**. BC Hydro is collecting information with this form for the purpose of its Site C Hydro Project and related energy resource options in accordance with BC Hydro's mandate under the **Hydro and Power Authority Act**, the BC Hydro Tariff, the **Utilities Commission Act** and related Regulations and Directions. If you have any questions regarding the Site C Hydro Project, and/or the information collection undertaken on this form, please contact the Site C Hydro Project at 1 877 217-0777.

For further information or to submit your feedback form:

Site C Clean Energy Project

PO Box 2218
Vancouver BC V6B 3W2
Toll-free: 1 877 217 0777
Email: sitec@bchydro.com

Community Consultation Offices:

9948 100th Avenue
Fort St. John BC V1J 1Y5
Tel: 250 785 3420
Pearkes Centre
10801 Dudley Street
Hudson's Hope, BC V0C 1V0

bchydro.com/sitec