BC Hydro
Power smart

February 10, 2020

Canadian Environmental Assessment Agency
National Programs Division
160 Elgin Street
Ottawa, ON K1A 0H3

Attn: Nicolas Courville, Compliance and Enforcement Officer

Dear Nicolas Courville:

Re: Site C Clean Energy Project - Proposed Design Changes to Highway 29 Crossings at Farrell Creek, Dry Creek and Lynx Creek

1. INTRODUCTION

On November 25, 2014, the Minister of the Environment issued a Decision Statement for the Site C Clean Energy Project setting out a description of the Project and the conditions under which the Project can be constructed and operated. The Decision Statement included the approval of works related to Highway 29, the two-lane highway connecting Hudson's Hope to Fort St. John along the north side of the Peace River. Segments of the highway will be inundated by the reservoir for the Site C Clean Energy Project (the Project), resulting in the need to realign approximately 30 km of existing highway at Bear Flat/Cache Creek, Halfway River, Farrell Creek, Dry Creek and Lynx Creek. The locations of these realignment segments are shown in each Figure 1 of Appendices A, B and C.

The purpose of this letter is to inform you about proposed changes to the design of the Highway 29 crossings at Farrell Creek, Dry Creek and Lynx Creek, as described in Section 4.3.4.1 (Table 4.5) of the Environmental Impact Statement (EIS). These changes which have been made based on information obtained through geotechnical investigations and stability analyses. Specifically, BC Hydro proposes that:

- a long bridge design replace the causeway and short bridge design currently described in the EIS for Farrell Creek
- a bridge replace the culvert currently described in the EIS for Dry Creek, and
- a same length causeway and longer bridge replace the causeway and bridge currently described in the EIS for Lynx Creek

This letter and attached Appendices A, B and C provide descriptions of the Farrell Creek, Dry Creek and Lynx Creek crossings respectively, including:

- The difference between the EIS designs and the proposed revised designs
- The impact of the revised designs to relevant valued components as assessed in the Project's EIS
- Studies on the designs submitted during the environmental assessment
- Indigenous group consultation on the proposed revisions
- Government approvals related to the proposed revisions

Appendix D, Proposed Revisions to the EIS, provides a redline version of the changes requested. Overall, the proposed design changes for the three crossings are not expected to cause any adverse effects on valued components beyond the effects that were considered during the environmental assessment of the Project. The proposed changes are expected to provide several benefits, including increased safety and stability of the crossings, and have smaller or similar aquatic and terrestrial footprints as the EIS crossings.

2. PROPOSED CHANGES TO HIGHWAY 29 CROSSINGS AT FARRELL, DRY AND LYNX CREEKS

Rationale for the Proposed Changes

As described in Section 4.3.4.2 of the EIS, a number of highway alignment alternatives were assessed for each of the Highway 29 realignment segments. Each alternative was evaluated in terms of relative safety, environmental effects (including those on fish, wildlife, and habitat), social effects (including those on property, heritage, and agriculture), and costs.

Since the Decision Statement for the Project was issued, BC Hydro and its design engineering teams have continued to work on the design of the Highway 29 realignments. In mid-2018, BC Hydro undertook geotechnical investigations to obtain additional information on site conditions. Further design analysis was also undertaken, resulting in the following design changes:

- **Farrell Creek Crossing:** Geotechnical investigations indicated that a zone of weathered shale exists between sand / gravel layers and shale bedrock at the Farrell Creek crossing. Given this information, geotechnical engineers determined that the planned causeway could only be made safe by flattening the causeway slopes and excavating and replacing the weak foundation soils with granular material. BC Hydro determined that this approach was not viable due to (a) a potential lack of locally sourced borrow and granular material; (b) slow construction progress due to additional excavation and foundation fills; and (c) associated construction costs. In the spring of 2019, BC Hydro therefore determined that the most cost effective alternative was to eliminate the short bridge plus causeway option, and to pursue a long bridge option, with conceptual parameters as described in Table 1: a bridge up to 450m in length, no causeway, and up to six piers.

- **Dry Creek Crossing**: Geotechnical investigations indicated that subsurface conditions were not conducive to the construction of the pipe-arch culvert as described in the EIS. A slope stability analysis revealed that the settlement criteria for the pipe-arch culvert could not be achieved without significant excavation of the foundation soils or the installation of deep piled foundations. Alternative bridge crossings were therefore assessed and evaluated based on several criteria, including road safety, hydrotechnical, structural, geotechnical, environmental, constructability, maintenance and overall cost. In the spring of 2019, BC Hydro determined that the most efficient alternative crossing at Dry Creek was a short bridge with conceptual parameters as described in Table 1: a bridge up to 200m and up to 3 piers.

- **Lynx Creek Crossing**: Refinements to the causeway and bridge lengths at the Lynx Creek Crossing were made through the design process to minimize elevation changes between the east and west approaches. The proposed revised causeway will remain the same length, and the bridge length will be up to 20m longer than the EIS design. These changes are required to

maximize sight distances along this segment of the highway, while also ensuring MOTI standards and guidelines for safety are met.

Proposed Design Changes To Be Reflected in EIS

Table 1 summarizes the proposed changes to the crossings as described in the EIS. As shown in Table 1, BC Hydro is also proposing to amend Figures 4.28, 4.29, and 4.30 to reflect the revised designs for each crossing. These figures are attached in Appendices A, B and C for the Farrell Creek, Dry Creek and Lynx Creek crossings respectively.

Table 1. Proposed Revisions to EIS Section 4.3.4.1, Table 4.5

Component	EIS Text	Proposed EIS Text
Highway 29 Realignment Farrell Creek Crossing	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Farrell Creek: Total Length of Segment: 2.0 km Causeway Length: 150 m Bridge Length: 170 m Number of Piers: N/A[1] Number of Bridge Spans: 2 Figure Number: Figure 4.30 Rev 0	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Farrell Creek: Total Length of Segment: **2.0 km** Causeway Length: **0 m** Bridge Length: **up to 450 m** Number of Piers: **up to 6** Number of Bridge Spans: **up to 7** Figure Number: **Figure 4.30 Rev 1**
Highway 29 Realignment Dry Creek Crossing	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Dry Creek: Total Length of Segment: 1.5 km Causeway Length: N/A[2] Bridge Length: 11 m pipe-arch culvert Number of Piers: N/A Number of Bridge Spans: N/A Figure Number: Figure 4.29 Rev 0	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Dry Creek: Total Length of Segment: **1.5 km** Causeway Length: **0 m** Bridge Length: **up to 200 m** Number of Piers: **up to 3** Number of Bridge Spans: **up to 4** Figure Number: **Figure 4.29 Rev 1**

[1] Table 4.5 in the EIS notes that the number of piers for the Farrell Creek Crossing is "N/A". However, EIS Figure 4.30 Rev 0 shows one pier.

[2] Table 4.5 in the EIS notes that the causeway length for Dry Creek is "N/A". However, approximately 1.7 ha of fill material would be placed in the Dry Creek valley for the culvert installation.

Component	EIS Text	Proposed EIS Text
Highway 29 Realignment Lynx Creek Crossing	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Lynx Creek: Total Length of Segment: 8.0 km Causeway Length: 290 m Bridge Length: 160 m Number of Piers: 1 Number of Bridge Spans: 2 Figure Number: Figure 4.28 Rev 0	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Lynx Creek: Total Length of Segment: **8.0 km** Causeway Length: **up to 290 m** Bridge Length: **up to 180 m** Number of Piers: **up to 3** Number of Bridge Spans: **up to 4** Figure Number: **Figure 4.28 Rev 1**

Assessment of Proposed Design Changes per Decision Statement

The Project Description in the Decision Statement focuses on the components of the Project:

> "BC Hydro and Power Authority (the Proponent) proposes to construct and operate a dam and 1,100-megawatt hydroelectric generating station on the Peace River in northeastern British Columbia. The Site C Clean Energy Project (the Designated Project) would be the third in a series of dams on the Peace River in British Columbia. The project components would consist of an earthfill dam 1,050 metres long and 60 metres high, a 1,100-megawatt generating station and associated structures, a 83-kilometre long reservoir, realignment of four sections of Highway 29, and two 77-kilometre transmission lines along an existing transmission line right-of-way connecting Site C to Peace Canyon."

No changes to the Project Description in the Decision Statement will be required as a result of the design changes for the crossings at Farrell, Dry and Lynx Creeks.

Appendices A, B and C provide information on the Farrell Creek, Dry Creek and Lynx Creek crossings respectively, including a description of crossing construction, assessment of potential impacts on valued components resulting from the design changes, and related provincial and federal government approvals/permits. As noted above, the proposed design changes for the three crossings are not expected to cause any adverse effects on valued components beyond the effects that were considered and approved during the environmental assessment of the Project.

3. RELATED STUDIES SUBMITTED DURING THE ENVIRONMENTAL ASSESSMENT

The following sections of the EIS provide additional information regarding the effects of the Highway 29 realignment for the Site C Project:

- Fish and Fish Habitat – EIS Volume 2, Section 12
- Vegetation and Ecological Communities – EIS Volume 2, Section 13
- Wildlife Resources – EIS Volume 2, Section 14

- Current Use of Lands and Resources for Traditional Purposes – EIS Volume 3, Section 19
- Harvest of Fish and Wildlife Resources – EIS Volume 3, Section 24
- Navigation – EIS Volume 3, Section 26
- Heritage Resources – EIS Volume 4, Section 32

4. INDIGENOUS GROUP CONSULTATION/ENGAGEMENT

Environmental Assessment

The Highway 29 realignments, including crossings at Farrell Creek, Dry Creek and Lynx Creek, were described in the Project's EIS. During the environmental assessment process for the Project, Indigenous groups provided feedback on the EIS, and through traditional land use studies, identified concerns regarding potential effects of the Project on fishing, hunting, trapping and other cultural and traditional uses of land and resources. Comments provided by Indigenous groups on the EIS, including concerns regarding the Highway 29 realignment, and BC Hydro's responses, are available on the EAO's website for the project.[3]

BC Hydro has invited Indigenous groups to ground truth Highway 29 realignment areas, including Farrell Creek, Dry Creek and Lynx Creek, and we will continue to work with interested Indigenous groups in this area with the goal of mitigating any site-specific concerns.

Environmental Assessment Certificate Amendment Request

BC Hydro is seeking an amendment to the Project's Environmental Assessment Certificate (EAC) to reflect the proposed changes to the Highway 29 crossings at Farrell, Dry and Lynx Creeks. BC Hydro's draft request to EAO to amend Section 4.3.4.1, Table 4.5 of Schedule A, EAC #E14-02 was provided to the following Indigenous groups on January 6, 2019: Blueberry River First Nations, Dene Tha' First Nation, Doig River First Nation, Duncan's First Nation, Fort Nelson First Nation, Horse Lake First Nation, Kelly Lake Métis Settlement Society, McLeod Lake Indian Band, Métis Nation British Columbia, Prophet River First Nation, Saulteau First Nations and West Moberly First Nations. BC Hydro requested that Indigenous groups provide comments by January 31, 2020 and offered to meet to review the draft amendment request. Indigenous groups were advised that their input would inform the final amendment request to be submitted in early February 2020.

BC Hydro did not receive any written comments from Indigenous groups on the draft EAC amendment request. On January 17, 2020, BC Hydro met with Saulteau First Nations to discuss the proposed amendments. Saulteau First Nations expressed an interest in the potential impacts of the design changes to fish. BC Hydro indicated that the removal of the causeway at Farrell Creek and the culvert at Dry Creek, and replacing these structures with bridges, would result in a smaller footprint and impact on fish and fish habitat.

BC Hydro also discussed the design for the Highway 29 realignment at Farrell Creek during a permitting forum with Indigenous groups on November 14, 2019. BC Hydro indicated that we would be seeking an EAC amendment to reflect the design changes that were presented at the forum. No questions

[3] The table of Information Requests from Indigenous groups and BC Hydro's responses can be found at https://projects.eao.gov.bc.ca/api/document/5887e157d876de1347b51259/fetch

regarding the EAC amendment were raised. The design for the Highway 29 realignments at Dry Creek and Lynx Creek will be discussed at a permitting forum scheduled for February 20, 2020.

Regulatory and compliance matters for BC Hydro's northeast projects (including Site C) are discussed during regular meetings with some BC Treaty 8 First Nations. Upon request, the Farrell Creek, Dry Creek, and Lynx Creek crossing design changes will also be introduced and discussed at meetings scheduled for the spring 2020.

5. ATTACHMENTS

Appendix A

- Proposed Revision to Farrell Creek Crossing

Appendix B:

- Proposed Revision to Dry Creek Crossing

Appendix C:

- Proposed Revision to Lynx Creek Crossing

Appendix D

- Extract of EIS showing the changes proposed in redline

6. CLOSURE

I trust this submission provides useful information regarding BC Hydro's proposed changes to Section 4.3.4.1, Table 4.5 of the EIS. We look forward to discussing these changes with you further. In the meantime, please don't hesitate to contact me if you have any questions or comments.

Regards,

<Original signed by>

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Regulatory Manager
Site C Clean Energy Project
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Cc: Julie Mallioux, Manager of Decision Statements, Impact Assessment Agency of Canada
Paul Schafer, Senior Advisor, Impact Assessment Agency of Canada
Shanna Mason, Environment, Permitting and Community Benefits Director, BC Hydro

Appendix A
Supporting Information for Proposed Revised Design
Farrell Creek Crossing

1. PROPOSED AMENDMENTS TO EIS TABLE 4.5

The location of the Highway 29 crossing at Farrell Creek is shown on Appendix A, Figure 1.

BC Hydro is proposing to replace the short bridge plus causeway option described in the EIS with a long bridge without a causeway that will be up to 450m long. BC Hydro is therefore proposing the following revisions to EIS Section 4.3.4.1, Table 4.5:

Component	EIS Text	Proposed Revisions to EIS Text
Highway 29 Realignment Farrell Creek Crossing	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Farrell Creek: Total Length of Segment: 2.0 km Causeway Length: 150 m Bridge Length: 170 m Number of Piers: N/A[4] Number of Bridge Spans: 2 Figure Number: Figure 4.30 Rev 0 (attached as Appendix A, Figure 2)	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Farrell Creek: Total Length of Segment: **2.0 km** Causeway Length: **0 m** Bridge Length: **up to 450 m** Number of Piers: **up to 6** Number of Bridge Spans: **up to 7** Figure Number: **Figure 4.30 Rev 1** (attached as Appendix A, Figure 3)

As shown in Figures 2, 3 and 6, the proposed design changes to the crossing will not materially change the alignment of the crossing, with the revised bridge design a few degrees offset from the EIS causeway. Overall, the removal of the causeway will reduce the environmental impact of construction below the future reservoir during the years leading up to inundation.

2. FARRELL CREEK BRIDGE CONSTRUCTION

Typical bridge construction practices, including the use of temporary laydown areas off the ends of the bridge, may be developed by the contractor to facilitate highway and bridge construction. By replacing the causeway with a longer bridge, BC Hydro will reduce the need to excavate and haul materials from external sources. Material required for highway embankments will be sourced locally from areas that will be inundated by the future reservoir, and potentially from future areas that will not be inundated by the future reservoir.

A concrete batch plant may be setup to produce concrete for the Farrell Creek Bridge. Steel piles and girders required in the bridge construction will be manufactured at, and delivered from, off-site facilities. Early in the construction of the Farrell Creek Bridge, approximately 250m of the existing Farrell Creek channel will be bermed to contain the creek to a defined channel, to facilitate construction of granular berms at the base of the west and east slopes of the Farrell Creek valley. These containment berms will be in-place until reservoir filling, currently scheduled for September 2023.

[4] Table 4.5 in the EIS notes that the number of piers for the Farrell Creek Crossing is "N/A". However, EIS Figure 4.30 Rev 0 shows one pier.

3. IMPACT TO VALUED COMPONENTS

The differences between the proposed revised design and the EIS design are not anticipated to cause any adverse effects on valued components beyond the effects that were considered and approved during the environmental assessment of the Project. For this assessment, the following valued components were reviewed and are described below: fish and fish habitat, vegetation and ecological communities, wildlife resources, harvest of fish and wildlife resources, current use of lands and resources for traditional purposes, navigation, and heritage resources. These valued comonents are reflected in seven Decision Statement Conditions:

- Condition 8 – fish and fish habitat, including identification of impacts to navigation
- Condition 9 – disturbance and destruction of migratory birds
- Condition 10 – non-wetland migratory bird habitat
- Condition 11 – wetlands used by migratory birds and for current use of lands and resources for traditional puproses
- Condition 14 – current use of land and resources for traditional purposes
- Condition 15 – archaeological and heritage resources
- Condition 16 – species at risk, at risk and sensitive ecological communities and rare plants

The following valued components were not assessed as they were determined to not interact either with the Highway 29 realignment or with the proposed revised design change to the Farrell Creek crossing: greenhouse gases, local government revenue, labour market, regional economic development, agriculture, forestry, oil, gas and energy, outdoor recreation and tourism, visual resources, population and demographics, housing, community infrastructure and services, transportation, and human health.

The assessment below is supported by information in Figures 4 and 5 – the EIS and Revised Design bridge profiles -- and Figure 6, a plan view of the EIS Schedule A bridge design versus the proposed revised design, post reservoir filling.

<u>Fish and Fish Habitat (Condition 8)</u>

The effects of the Project on fish and fish habitat were assessed in the environmental assessment by considering changes to fish habitat, fish health and survival, and fish movement. As described in the EIS, the section of Farrell Creek adjacent to the realignment provides rearing and feeding habitats for sucker and minnow species, and acts as a migration corridor for fish moving between the Peace River and spawning and rearing habitats further upstream. The EIS concluded that the construction of the Highway 29 realignment at Farrell Creek would not result in a potential loss of fish habitat. The EIS also concluded that the construction of Highway 29 realignments would not result in adverse residual effects on fish health and survival or fish movement if mitigation measures, such as erosion and sediment control, are implemented.

The proposed revision to the Farrell Creek Bridge design is not anticipated to affect the conclusions of the environmental assessment regarding the effects of the Project on fish and fish habitat. Both the EIS bridge design and the proposed revised design cross Farrell Creek at a location that will be converted from stream to reservoir habitat following reservoir filling. The revised design includes an additional pier inside the present channel high-water-mark, but the elimination of the causeway will result in an overall reduced aquatic footprint. The causeway would have required substantial fill placement in and around the present creek channel.

The containment channel to be constructed for the revised design would have also been required for the original EIS design. This channel will maintain fish access to upstream habitat throughout the construction period, and isolation of the pier works areas from flowing water.

Final design details are pending for the proposed revised bridge. A detailed assessment of the instream impacts of the piers per the final bridge design will be undertaken by a qualified environmental professional prior to construction of the bridge, in accordance with the federal *Fisheries Act*.

Vegetation and Ecological Communities and Wildlife Resources (Conditions 8, 9, 10, 11 and 16)

The effects of the Highway 29 realignment on vegetation and ecological communities were assessed as part of the assessment of the effects of the Project on vegetation and ecological communities. That assessment focused on the key indicators of terrestrial ecosystems and rare plants. The effects of the Project on terrestrial ecosystems and rare plants were determined in the EIS to be significant due to Project impacts on rare ecological communities and rare plants.

The effects of the Highway 29 realignment on wildlife resources were assessed as part of the effects of the Project on wildlife resources. That assessment focused on a number of wildlife key indicators under the species groups of butterflies and dragonflies, amphibians and reptiles, migratory birds, non-migratory game birds, raptors, bats, fur-bearers, ungulates, and large carnivores. The effects of the Project on wildlife resources were determined to be significant due to the alteration and fragmentation of habitat for avian species of provincial and federal conservation concern.

The proposed modification to the Farrell Creek Bridge design is not expected to cause any additional effects on vegetation and ecological communities or wildlife resources beyond those predicted in the EIS. As shown in Figure 6, the 150m causeway per the EIS design will be replaced by piers in the proposed revised design. This change does not increase the terrestrial footprint of the Farrell Creek crossing. Therefore, this revised design would not change the conclusions of the EIS regarding vegetation and ecological communities, or wildlife resources.

Harvest of Fish and Wildlife Resources (Condition 14)

Project effects on the harvest of fish and wildlife resources were assessed in the EIS by considering Project changes to the use of and access to hunting, fishing, trapping, and guide outfitter areas, tenure areas, or the availability of harvested species based on the results of the assessment of the Project on fish and wildlife resources. Because the proposed modified design of the Farrell Creek Bridge will not result in any additional effects on fish and fish habitat, vegetation and ecological communities, and wildlife resources, it is not expected to cause any additional effects on the harvest of fish and wildlife resources beyond those predicted in the EIS.

Current Use of Lands and Resources for Traditional Purposes (Condition 14)

Project effects on Current Use of Lands and Resources for Traditional Purposes were assessed in the EIS by considering Project changes to current use of lands and resources for hunting, fishing and trapping activities, as well as current use of lands and resources for activities other than hunting, fishing and trapping by Indigenous groups, including cultural activities. The revised design of the Farrell Creek Bridge will result in reduced interactions with fish and fish habitat, and will not result in any additional effects

on vegetation and ecological communities or wildlife resources. In addition, the revised design will not result in any additional effects on activities other than hunting, fishing or trapping by Indigenous groups, including effects on cultural activities. Therefore, the revised design is not expected to cause any additional effects on the current use of lands and resources beyond those predicted in the EIS.

Navigation (Condition 8)

The proposed revision to the Farrell Creek Bridge design is not expected to result in any additional effects on navigation beyond those predicted in the EIS. The Farrell Creek Bridge design in the EIS includes a single pier and a minimum navigation clearance envelope equal to 8m high (as measured from maximum normal reservoir elevation, 461.8m) and 25m wide (Figures 4 and 5). During the environmental assessment, Transport Canada provided an analysis that resulted in the recommendation that the Farrell Creek Bridge design contain a clearance envelope that is 8m high, as measured from the 461.8m reservoir elevation level, and 25m wide.[5] The proposed revised bridge design meets these requirements.

In addition, the overall boater access beneath the bridge is expected to improve as the revised design provides a wider wetted channel in the area below the bridge deck due to the elimination of the 150m causeway described in the EIS. Navigation channel marks and boater notifications for the modified bridge would meet all requirements for compliance under the *Canadian Navigable Waters Act*. No additional restrictions to boater access are expected to result from the changes to the design. Decommissioning of the existing Farrell Creek Bridge will be confirmed through discussions with Transport Canada and the Ministry of Transportation and Infrastructure. If the structure is left in place, the bridge deck will be 10.7m below minimum normal reservoir level of 460.0 m (i.e. existing bridge deck elevation = 449.3m), which will not interfere with boater traffic.

Heritage Resources (Condition 15)

A comprehensive Effects Assessment for Heritage Resources was undertaken for the EIS (see EIS Volume 4 Appendix C, Technical Appendix: Heritage Resource Assessment Report). Information and data for the Effects Assessment was drawn from 1) literature reviews, including palaeontological resources, archaeological resources, and historical resources, 2) consultation between BC Hydro and Indigenous groups, and 3) an extensive, multi-year field inventory and survey.

The proposed modification to the Farrell Creek Bridge design is not expected to cause any additional effects on heritage resources because the footprint for the new design is entirely contained within the footprint of the original design, and the entirety of this area was previously considered and assessed. All Archaeological Impact Assessment and Systematic Data Recovery (SDR) required has been completed to Project and Heritage Conservation Act Permit standards.

4. GOVERNMENT APPROVALS/ENDORSEMENTS

BC Hydro has submitted applications for the following permits and approvals related to the Highway 29 realignment at Farrell Creek:

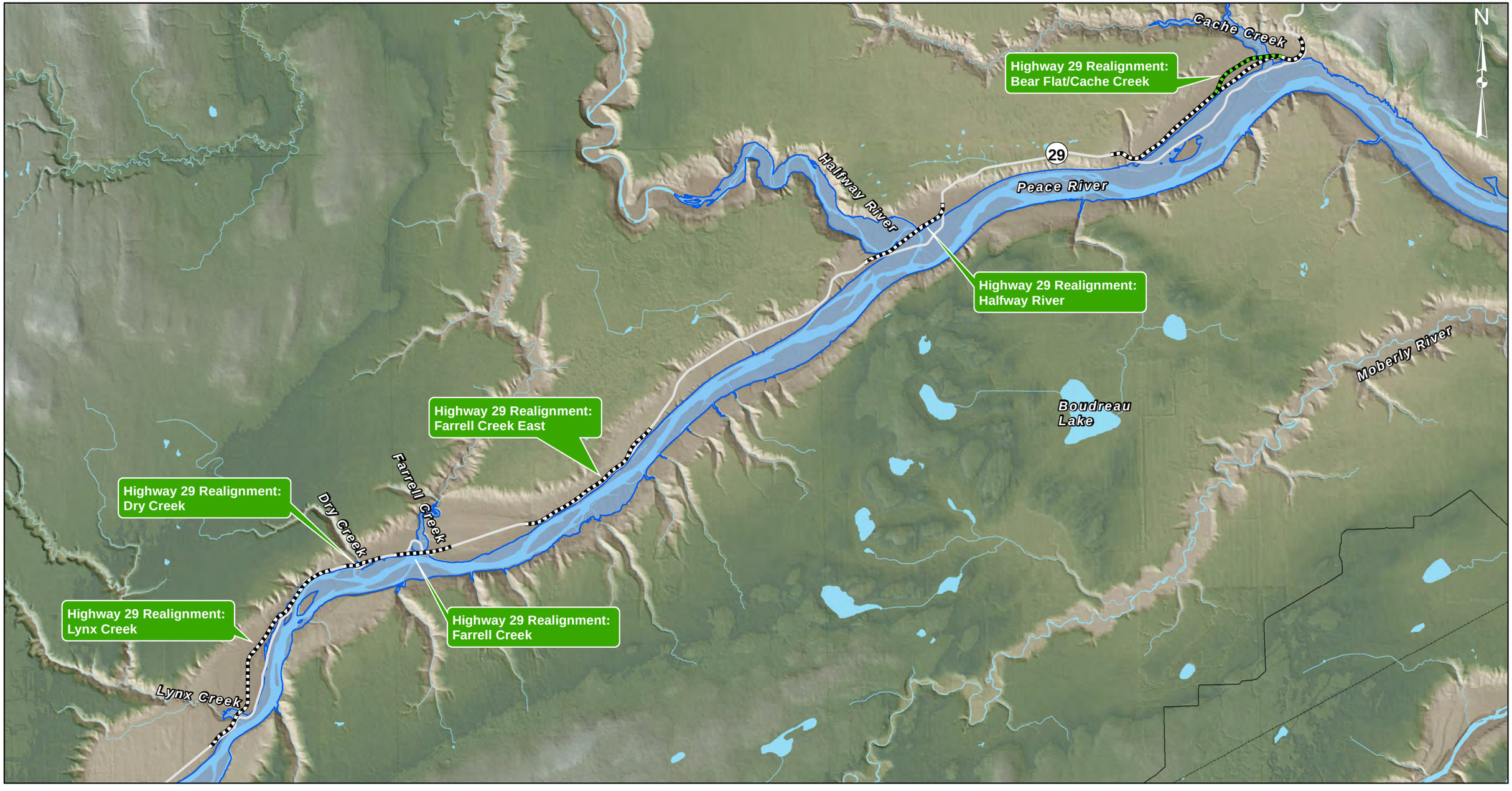
[5] https://projects.eao.gov.bc.ca/api/document/58868f2fe036fb0105767ecf/fetch

- Request to amend EAC #E14-03, Section 4.3.4.1, Table 4.5, regarding Highway 29 Design Changes at Farrell, Dry and Lynx Creeks (application submitted February 4, 2020)
- *Land Act* Licence of Occupation (application submitted November 8, 2019)
- *Forest Act* Occupant Licence to Cut #20 (permit issued November 15, 2019)
- *Water Sustainability Act* Section 11 Approval for instream works (application submitted November 12, 2019)
- *Canadian Navigable Waters Act* Approval or Notice of Work (application submitted November 8, 2019)

In addition, an assessment by a Qualified Environmental Professional of potential impacts to fish and fish habitat will be undertaken in accordance with the federal *Fisheries Act.*

5. ATTACHMENT - FIGURES

- Figure 1: Location of Highway 29 realignment segments, including Farrell Creek
- Figure 2: General arrangement of Highway 29 realignment segment at Farrell Creek, per EIS Design (Figure 4.30 Rev 0)
- Figure 3: General arrangement of Highway 29 realignment segment at Farrell Creek, per proposed design (proposed Figure 4.30 Rev 1).
- Figure 4: Profile of Farrell Creek Bridge, per EIS Design (not to scale)
- Figure 5: Profile of Farrell Creek Bridge, per proposed design (not to scale)
- Figure 6: Farrell Creek Bridge - EIS Design versus Proposed Design



Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
5. Highway design in progress and subject to change.

Legend

- Proposed Highway 29 Realignment
- Approved Highway 29 Realignment
- Highway 29
- Proposed Reservoir

1:134,000 0 1.5 3 6 km

BC Hydro

Figure 1: Location of Highway 29 realignment segments

Date	Dec 9, 2019	DWG NO	1016-N11-00712	R 0

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

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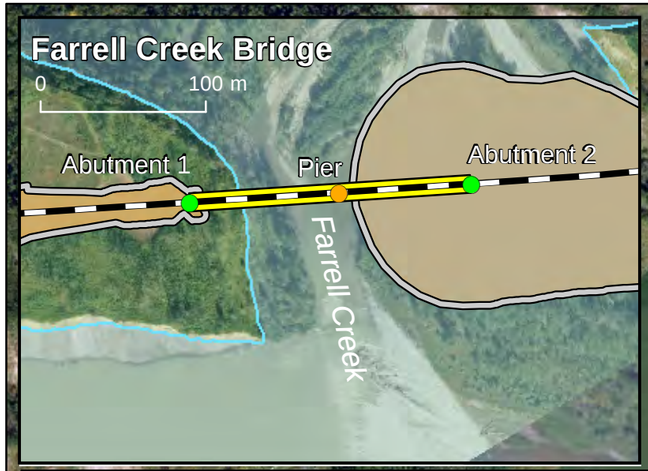
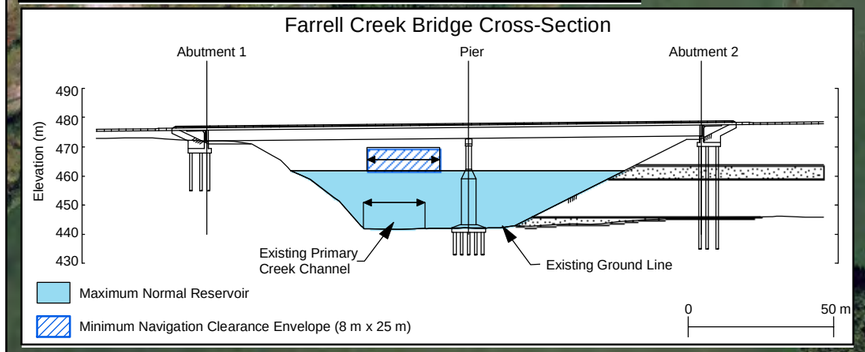
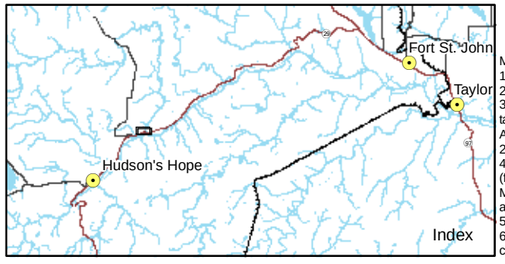






Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos created from 1:40,000 photos taken Sept10th 2007; 1:15,000 photos taken Aug 26, 2011; 1:5,000 photos taken Aug 26, 2011; TRIM
4. Proposed maximum normal reservoir level (full supply level-461.8 m) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/Aug 2006.
5. Realignments subject to change.
6. Reservoir elevation = 461.8 m does not consider realignments.

Legend

- Highway 29 Realignment
- Proposed Bridge
- Road Embankment
- Pier
- Abutment
- Maximum Normal Reservoir Level (461.8 m)
- Existing Highway 29

1:7,000

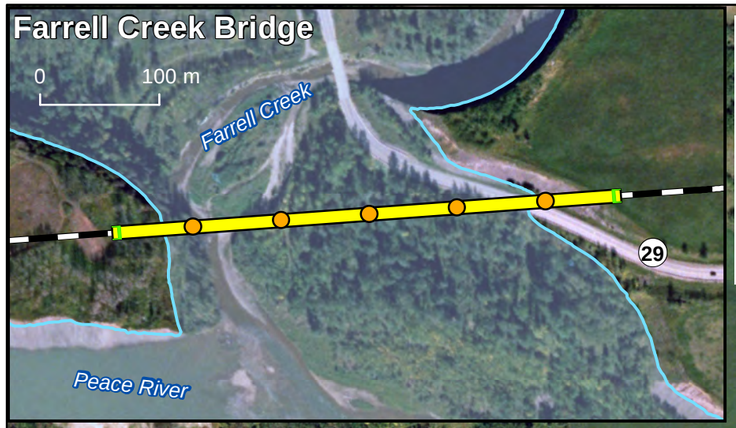
0 0.25 km

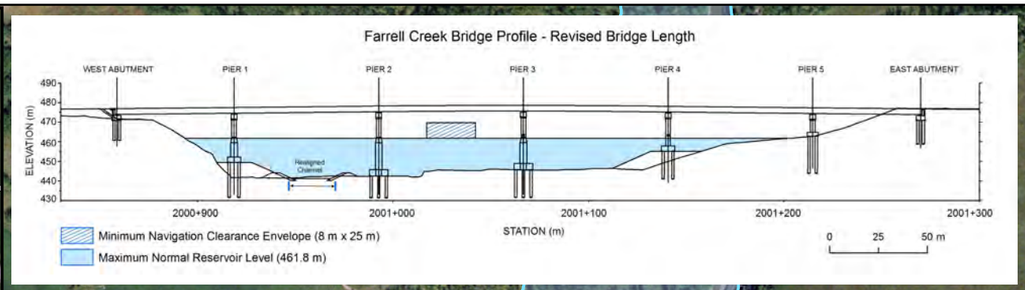
SITE C CLEAN ENERGY PROJECT

BC hydro

Figure 4.30
General arrangement of Highway 29 realignment segment at Farrell Creek

Date	Nov. 23, 2012	DWG NO	1016-C14-B6158-16	R 0





Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007;
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
6. Reservoir elevation 461.8 m does not consider realignment.

Legend

- Highway 29 Realignment
- Revised Farrell Creek Bridge Design
- Pier
- Abutment
- Maximum Normal Reservoir Level (461.8 m)

1:7,000

0 150 300 m

BC Hydro

Figure 3: General arrangement of Highway 29 realignment segment at Farrell Creek, per proposed revised bridge design (proposed Figure 4.30 Rev 1)

Date	Dec 4, 2019	DWG NO	1016-C14-B6158-16	R 1

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

Path: X:\ArcGIS\Projects\Regulatory\EAC_Amend\FarrellCreek\FarrellCreek_HwyRealign_EAC_1016_C14_B6158-16.mxd

Figure 4: Profile of Farrell Creek Bridge, per EIS Design (not to scale)

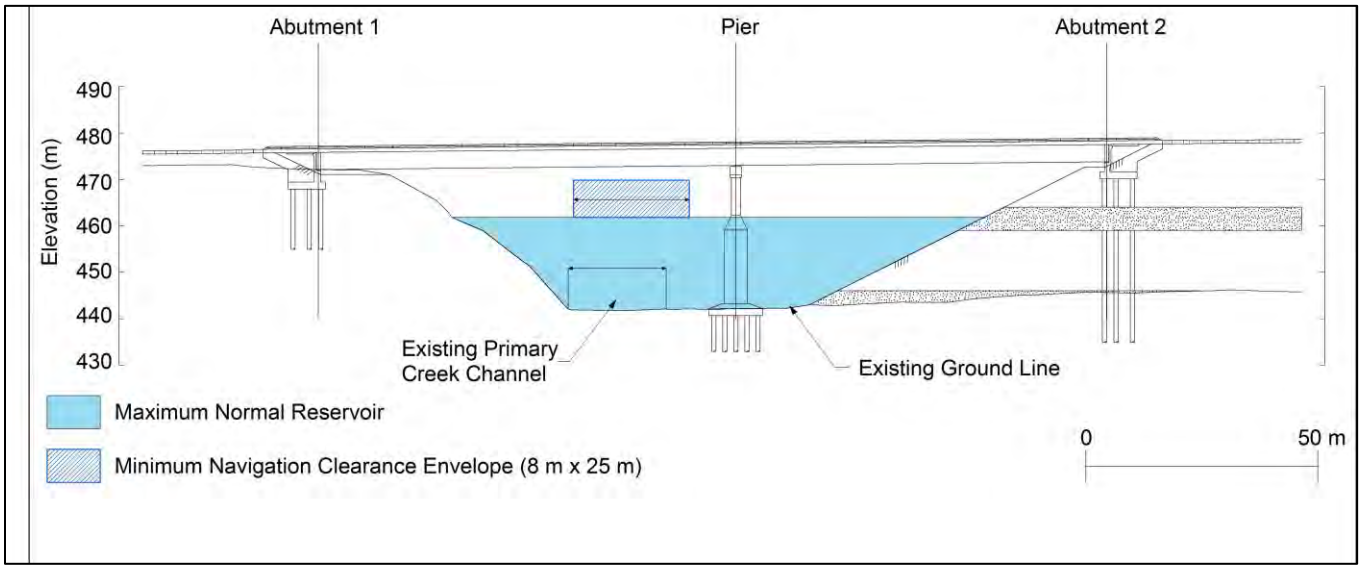
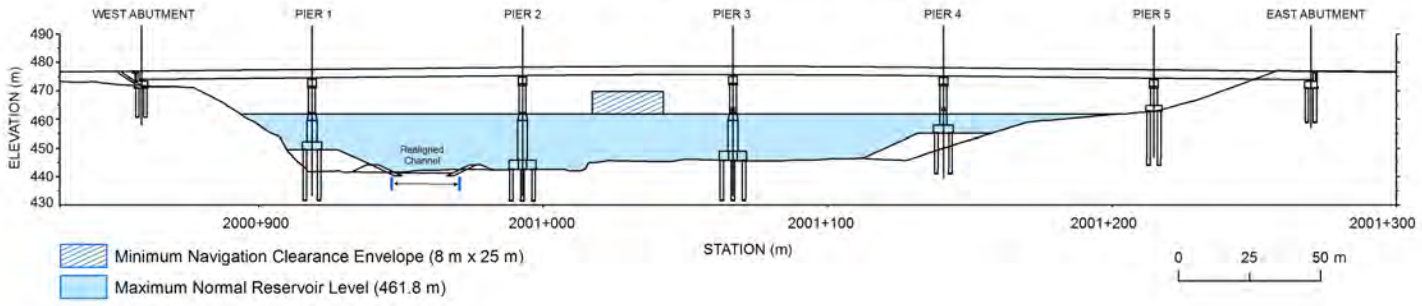
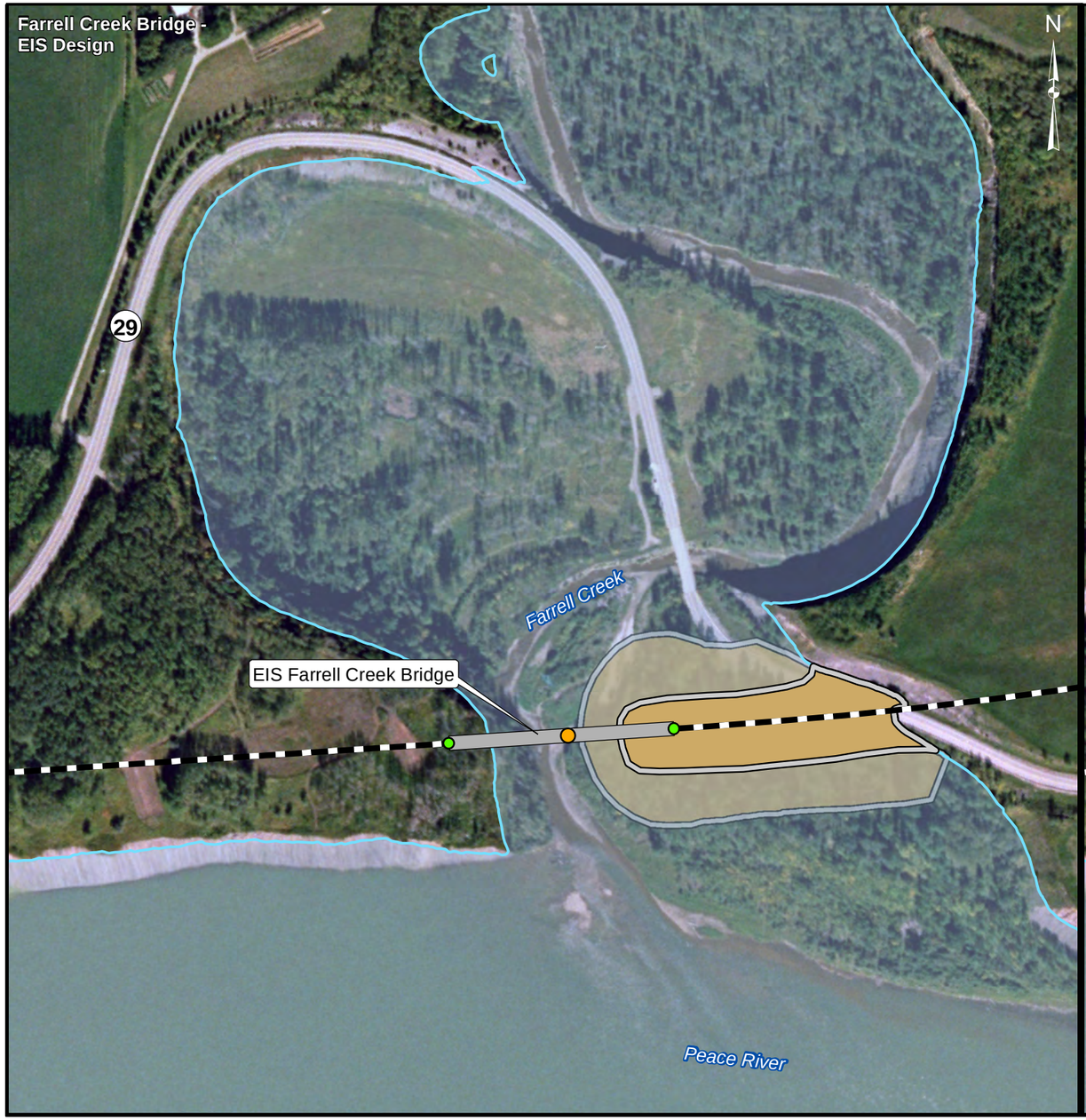
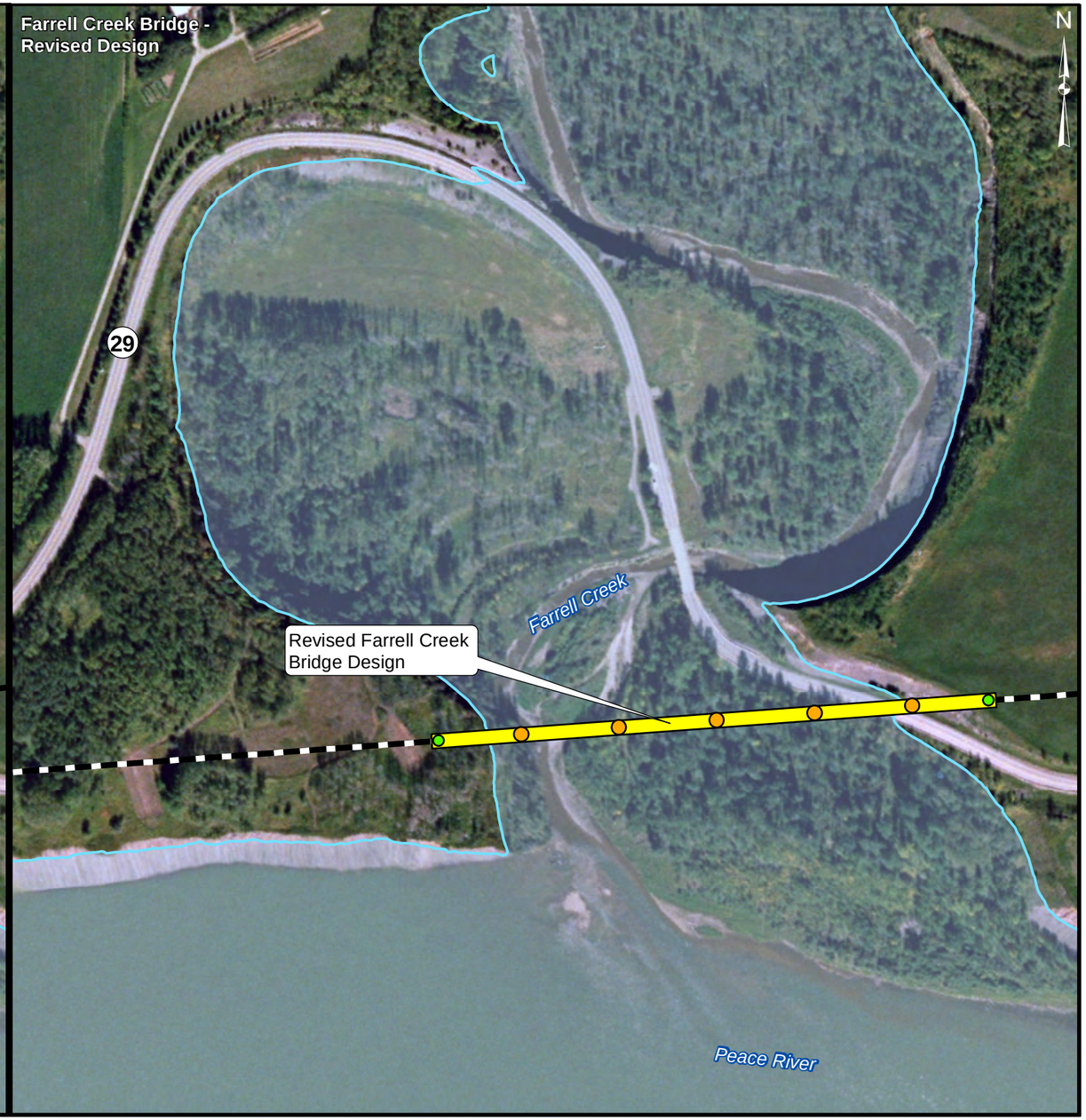
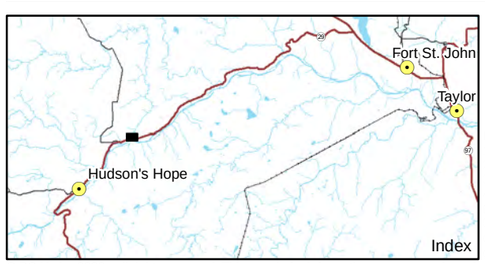


Figure 5: Profile of Farrell Creek Bridge, per proposed revised design (not to scale)









Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.

Legend

- Highway 29 Realignment
- EIS Farrell Creek Bridge
- Revised Farrell Creek Bridge Design
- Pier
- Abutment
- Causeway
- Maximum Normal Reservoir Level (461.8 m)

1:4,000 0 100 200 m

BC Hydro

Figure 6: Farrell Creek Bridge - EIS vs Revised Design

Date	Feb 10, 2020	DWG NO	1016-N11-00751	R 0

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

Path: X:\ArcGIS\Projects\Regulatory\EAC_Amend\FarrellCreek\FarrellCreek_HwyRealign_JAA_1016_N11_00751.mxd

Appendix B
Supporting Information for Proposed Revised Design
Dry Creek Crossing

1. PROPOSED AMENDMENTS TO EIS TABLE 4.5

The location of the Highway 29 crossing at Dry Creek is shown on Appendix B, Figure 1.

For the Highway 29 crossing at Dry Creek, BC Hydro is proposing to replace the culvert described in the EIS with a bridge that will be up to 200m long. BC Hydro is therefore proposing the following revisions to EIS Section 4.3.4.1, Table 4.5:

Component	EIS Text	Proposed Revisions to EIS Text
Highway 29 Realignment Dry Creek	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Dry Creek: Total Length of Segment: 1.5 km Causeway Length: N/A* Bridge Length: 11 m pipe-arch culvert Number of Piers: N/A Number of Bridge Spans: N/A Figure Number: Figure 4.29 Rev 0 (attached as Appendix B, Figure 2)	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Dry Creek: Total Length of Segment: **1.5 km** Causeway Length: **0 m** Bridge Length: **up to 200 m** Number of Piers: **up to 3** Number of Bridge Spans: **up to 4** Figure Number: **Figure 4.29 Rev 1** (attached as Appendix B, Figure 3)

The Dry Creek crossing, as described in the EIS, consisted of a large culvert and embankment fill to cross the approximately 200m wide Dry Creek valley. In order to complete these works, a temporary diversion of Dry Creek would have been required and likely would have consisted of a temporary culvert to divert creek flows during the installation of the permanent culvert. This creek temporary diversion structure would have been constructed entirely within the area of disturbance assessed for the EIS.

The proposed revised crossing alignment is located at its widest point approximately 85m to the north of the EIS alignment. Much of the proposed revised crossing location is within the area of disturbance assessed for the EIS. However, as described below, temporary containment berms will be required to isolate Dry Creek from the bridge pier footing sites. These containment berms will extend north of the area of disturbance as assessed in the EIS, and have been considered in the evaluation of impacts of the proposed revised design on valued components.

2. DRY CREEK BRIDGE CONSTRUCTION

Typical bridge construction practices, including the use of temporary laydown areas off the ends of the bridge, may be developed by the contractor to facilitate highway and bridge construction. Material required for highway embankments will be sourced locally from areas that will be inundated by the future reservoir and, potentially, from future areas that will not be inundated by the future reservoir. A concrete batch plant may be setup to produce concrete for the Dry Creek Bridge. Steel piles and girders required in the bridge construction will be manufactured at, and delivered from, off-site facilities. Early in the construction of the Dry Creek Bridge, approximately 250m of the existing Dry Creek channel will be bermed to contain the creek to a defined channel, to facilitate construction of granular berms at the base of the west and east slopes of the Dry Creek valley. These containment berms will be in-place until

reservoir filling, currently scheduled for September 2023. Although not anticipated at this time, temporary diversion of Dry Creek may be required as the design and construction process is refined.

3. IMPACT TO VALUED COMPONENTS

The differences between the proposed revised design and the EIS design are not anticipated to cause any adverse effects on valued components beyond the effects that were considered and approved during the environmental assessment of the Project. For this assessment, the following valued components were reviewed and are described below: fish and fish habitat, vegetation and ecological communities, wildlife resources, harvest of fish and wildlife resources, current use of lands and resources for traditional purposes, navigation, and heritage resources. These valued comonents are reflected in seven Decision Statement Conditions:

- Condition 8 – fish and fish habitat, including identification of impacts to navigation
- Condition 9 – disturbance and destruction of migratory birds
- Condition 10 – non-wetland migratory bird habitat
- Condition 11 – wetlands used by migratory birds and for current use of lands and resources for traditional puproses
- Condition 14 – current use of land and resources for traditional purposes
- Condition 15 – archaeological and heritage resources
- Condition 16 – species at risk, at risk and sensitive ecological communities and rare plants

The following valued components were not assessed as they were determined to not interact either with the Highway 29 realignment or with the proposed revised design change to the Dry Creek crossing: greenhouse gases, local government revenue, labour market, regional economic development, agriculture, forestry, oil, gas and energy, outdoor recreation and tourism, visual resources, population and demographics, housing, community infrastructure and services, transportation, and human health.

The assessment is supported by information in Figures 4 and 5 – the EIS Culvert and Revised Design Bridge profiles -- and Figure 6, a plan view of the EIS culvert design versus the proposed revised bridge design, post reservoir filling.

Fish and Fish Habitat (Condition 8)

The effects of the Project on fish and fish habitat were assessed in the environmental assessment by considering changes to fish habitat, fish health and survival, and fish movement. Fish habitat and fish use data for Dry Creek are limited. Based on historical aerial photographs, Dry Creek remains disconnected from the mainstem of the Peace River except under freshet conditions. The existing Dry Creek culvert crossing at Highway 29 is a 1,800-mm diameter corrugated steel pipe with a perched outlet that impedes upstream fish passage. Additionally, approximately 150 linear metres of Dry Creek immediately upstream from its confluence with the Peace River is typically dewatered during low flow period, with apparent subsurface flows within the alluvial fan. This dewatering and presence of the impassible culvert currently precludes fish access and use of Dry Creek for Peace River fish populations. As such, use of Dry Creek by Peace River fish populations is expected to be very low.

The proposed design changes to the Highway 29 realignment at Dry Creek are not anticipated to affect the conclusions of the environmental assessment regarding the effects of the Project on Fish and Fish Habitat. Both the EIS crossing and proposed revised crossing at Dry Creek are at a location that will be

converted from stream to reservoir habitat following reservoir filling. The culvert (11m pipe-arch) and surrounding infill area in the EIS design would have encroached on a substantial portion of the present creek channel and blocked aerial input of food and nutrients from above the channel. The revised design includes a pier and diversion berm in the present channel, but the elimination of the culvert infill area will result in an overall reduced acquatic footprint.

The containment channel to be constructed for the revised design would have also been required for the EIS design. This channel will maintain downsteam passage for migrating fish, and will have similar habitat functions as the existing creek channel. Once the future reservoir is created, the open water in the proposed revised bridge design will create better aquatic habitat conditions than the culvert. Overall, the construction and post-construction conditions for fish and fish habitat are expected to improve as a result of the design changes.

A detailed assessment of the instream impacts of the piers per the final bridge design will be undertaken by a qualified environmental professional prior to construction of the bridge, in accordance with the federal *Fisheries Act*.

Vegetation and Ecological Communities and Wildlife Resources (Conditions 8, 9, 10, 11, and 16)

The effects of the Highway 29 realignment on vegetation and ecological communities were assessed as part of the assessment of the effects of the Project on vegetation and ecological communities. That assessment focused on the key indicators of terrestrial ecosystems and rare plants. The effects of the Project on terrestrial ecosystems and rare plants were determined in the EIS to be significant due to Project impacts on rare ecological communities and rare plants.

The effects of the Highway 29 realignment on wildlife resources were assessed as part of the effects of the Project on wildlife resources. That assessment focused on a number of wildlife key indicators under the species groups of butterflies and dragonflies, amphibians and reptiles, migratory birds, non-migratory game birds, raptors, bats, fur-bearers, ungulates, and large carnivores. The effects of the Project on wildlife resources were determined to be significant due to the alteration and fragmentation of habitat for avian species of provincial and federal conservation concern.

The proposed revision to the design of the Dry Creek crossing is not expected to cause any additional effects on vegetation and ecological communities or wildlife resources beyond those predicted in the EIS. As shown in Figures 6, the culvert and associated infill per the EIS design will be replaced by bridge up to 200m long, resulting in a small decrease in the terrestrial footprint of the Dry Creek crossing.

The revised bridge design is expected to increase disturbance to the blue-listed Fm02 – Balsam poplar – White spruce/Mountain alder – red-osier dogwood ecological community by approximately 0.8 ha. As the effects of the Project on this ecological community were predicted in the EIS to be high magnitude, the 0.8 ha increase in disturbance to this community due to the revised design does not change the conclusions of the EIS regarding vegetation and ecological communities.

As the revised design results in an overall decrease in the terrestrial footprint of the Dry Creek crossing, it also does not change the conclusions of the EIS regarding wildlife resources.

Harvest of Fish and Wildlife Resources (Condition 14)

Project effects on the harvest of fish and wildlife resources were assessed in the EIS by considering Project changes to the use of and access to hunting, fishing, trapping, and guide outfitter areas, tenure areas, or the availability of harvested species based on the results of the assessment of the Project on fish and wildlife resources. Because the proposed revised design of the Dry Creek Bridge will not result in any additional effects on fish and fish habitat, vegetation and ecological communities, and wildlife resources, it is not expected to cause any additional effects on the harvest of fish and wildlife resources beyond those predicted in the EIS.

Current Use of Lands and Resources for Traditional Purposes (Condition 14)

Project effects on current use of lands and resources for traditional purposes were assessed in the EIS by considering Project changes to current use of lands and resources for hunting, fishing and trapping activities, as well as current use of lands and resources for activities other than hunting, fishing and trapping by Indigenous groups, including cultural activities. The revised design of the Dry Creek crossing will result in reduced interactions with fish and fish habitat, and will not result in any additional effects on vegetation and ecological communities or wildlife resources. In addition, the revised design is not expected to result in any additional effects on activities other than hunting, fishing or trapping by Indigenous groups, including cultural activities. Therefore, the revised design is not expected to cause any additional effects on the current use of lands and resources beyond those predicted in the EIS.

Navigation (Condition 8)

The proposed revision to the Dry Creek crossing design is not expected to result in any additional effects on navigation beyond those predicted in the EIS. The Dry Creek crossing design in the EIS did not show a navigation envelope for vessels as the crossing was designed as a culvert. During the environmental assessment, Transport Canada provided an analysis that resulted in the recommendation that the Farrell, Lynx and Cache Creek Bridge designs contain a clearance envelope that is 8m high, as measured from the 461.8m reservoir elevation level, and 25m wide; however, Dry Creek was not assigned a minimum clearance envelope.[6]

The proposed revised bridge design would have a clearance envelope that is 3m high, 10m wide in accordance with a memo sent to Transport Canada regarding Highway 29 bridge crossings.[7] Based on the water depths and minimal wetted area upstream of this crossing as well as the navigation clearance envelope, the proposed revisions at the Dry Creek Highway 29 crossing is not expected to result in reductions in boater access or navigation.

Navigation channel marks and boater notifications for the revised bridge would meet all requirements for compliance under the *Canadian Navigable Waters Act*.

[6] https://projects.eao.gov.bc.ca/api/document/58868f2fe036fb0105767ecf/fetch

[7] Memo to Transport Canada from Siobhan Jackson (BCH), RE: Site Clean Energy Project: Navigation Clearances for Highway 29 Bridge Crossings. 11 October, 2011.

Heritage Resources (Condition 15)

A comprehensive Effects Assessment for Heritage Resources was undertaken for the EIS (see EIS Volume 4 Appendix C, Technical Appendix: Heritage Resource Assessment Report). Information and data for the Effects Assessment was drawn from 1) literature reviews, including palaeontological resources, archaeological resources, and historical resources, 2) consultation between BC Hydro and Indigenous groups, and 3) an extensive, multi-year field inventory and survey.

The proposed revision to the Dry Creek crossing design is not expected to cause any additional effects on heritage resources because the footprints of the original and the new designs are both entirely contained within the area previously considered and assessed for heritage resources. There are no known archaeology sites in conflict with the bridge footprint. All Archaeological Impact Assessment and Systematic Data Recovery (SDR) required for the Dry Creek highway segment has been completed to Project and Heritage Conservation Act Permit standards.

4. GOVERNMENT APPROVALS/ENDORSEMENTS

On February 4, 2020, BC Hydro submitted a request to amend EAC #E14-03, Section 4.3.4.1, Table 4.5, regarding Highway 29 Design at Farrell, Dry and Lynx Creeks.

BC Hydro will be submitting applications for the following permits and approvals related to the Highway 29 realignment at Dry Creek:

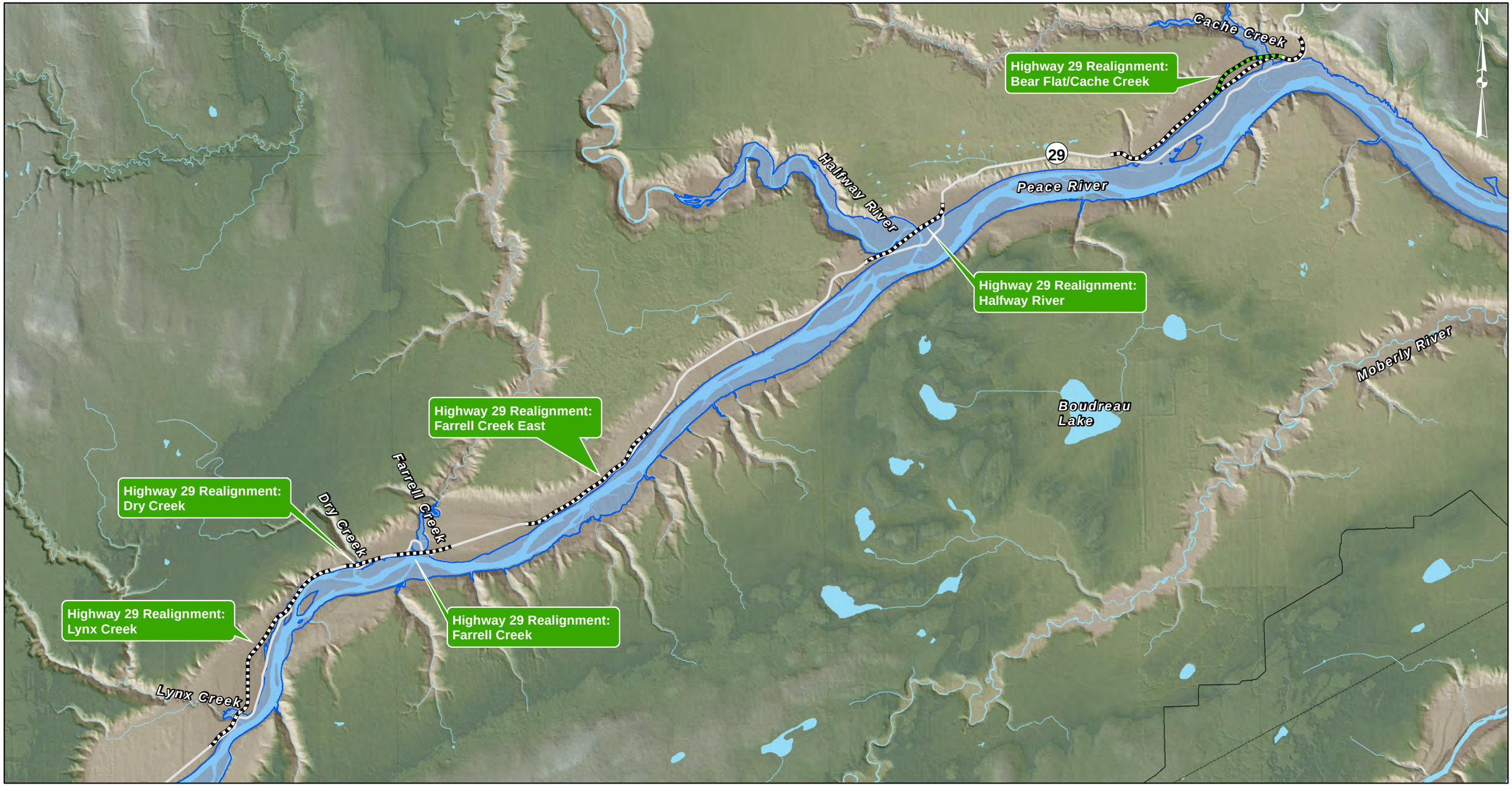
- *Land Act* Licence of Occupation (planned application date December 2019)
- *Forest Act* Occupant Licence to Cut (issued November 15, 2019)
- *Water Sustainability Act* Section 11 Approval for instream works (application submitted November 29, 2019)
- *Water Sustainability Act* Section 10 Approval for Short Term Use (planned application date December 2019)
- *Canadian Navigable Waters Act* Approval or Notice of Work (application submitted November 29, 2019)

In addition, an assessment by a Qualified Environmental Professional of potential impacts to fish and fish habitat will be undertaken in accordance with the federal *Fisheries Act.*

5. ATTACHMENTS

Appendix A: Figures

- Figure 1: Location of Highway 29 realignment segments, including Dry Creek
- Figure 2: General arrangement of Highway 29 realignment segment at Dry Creek, per EIS Design (Figure 4.29 Rev 0)
- Figure 3: General arrangement of Highway 29 realignment segment at Dry Creek, per proposed revised design (proposed Figure 4.29 Rev 1).
- Figure 4: Profile of Dry Creek Culvert, per EIS Design (not to scale)
- Figure 5: Profile of Dry Creek Bridge, per proposed revised design (not to scale)
- Figure 6: Dry Creek Bridge - EIS Design versus Revised Design



Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
5. Highway design in progress and subject to change.

Legend

- Proposed Highway 29 Realignment
- Approved Highway 29 Realignment
- Highway 29
- Proposed Reservoir

1:134,000 0 1.5 3 6 km

BC Hydro

Figure 1: Location of Highway 29 realignment segments

Date	Dec 9, 2019	DWG NO	1016-N11-00712	R 0

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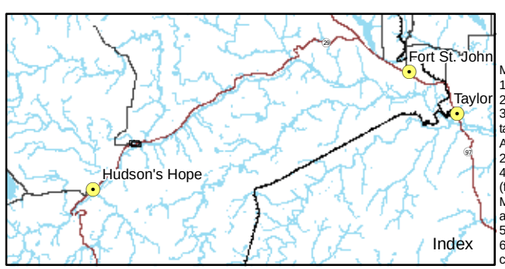


Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos created from 1:40,000 photos taken Sept10th 2007; 1:15,000 photos taken Aug 26, 2011; 1:5,000 photos taken Aug 26, 2011; TRIM
4. Proposed maximum normal reservoir level (full supply level-461.8 m) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/Aug 2006.
5. Realignments subject to change.
6. Reservoir elevation = 461.8 m does not consider realignments.

Legend

- Highway 29 Realignment
- Pipe Arch
- Maximum Normal Reservoir Level (461.8 m)

1:5,000

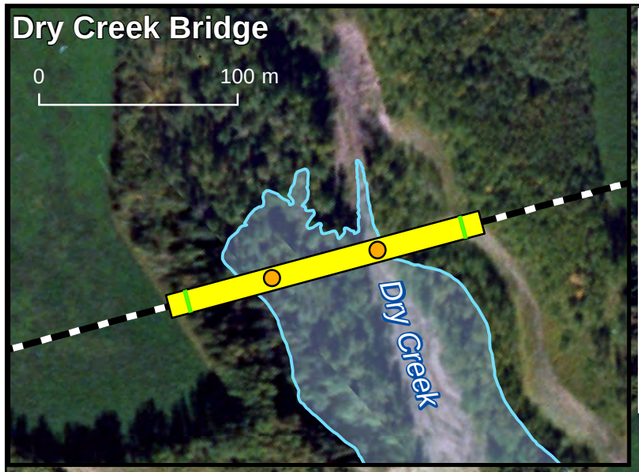
0 0.25 km

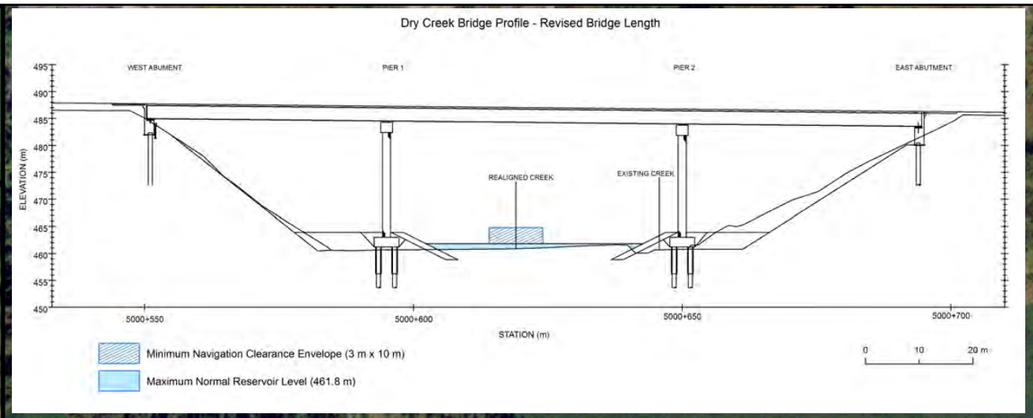
BC hydro

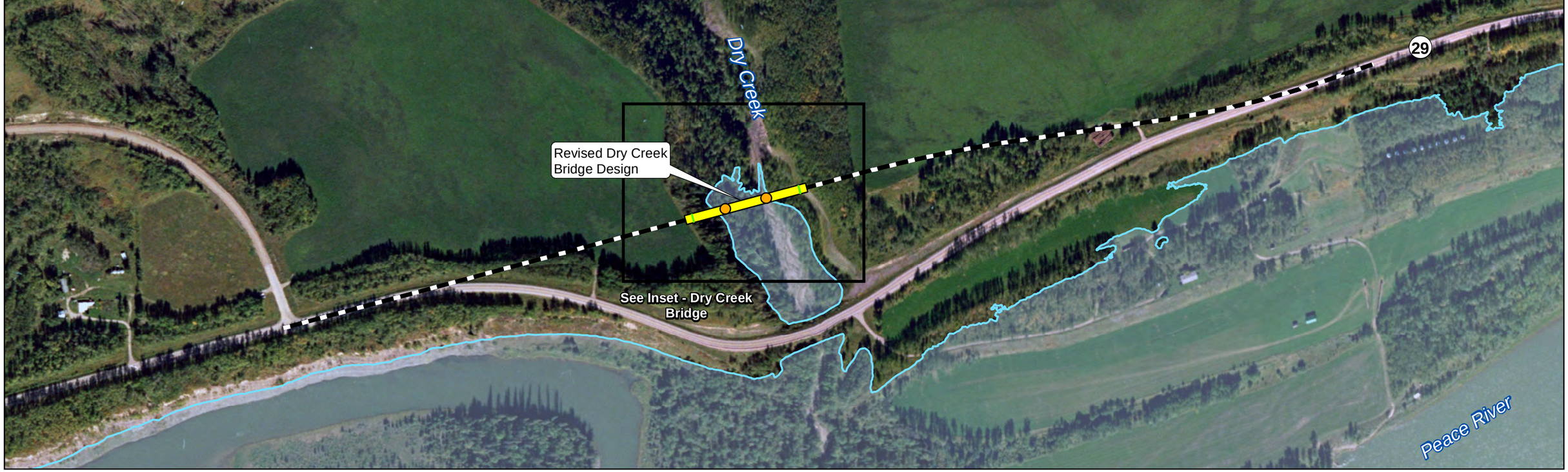
SITE C CLEAN ENERGY PROJECT

Figure 4.29
General arrangement of Highway 29 realignment segment at Dry Creek

Date	Nov. 23, 2012	DWG NO	1016-C14-B6158-15	R 0







Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007;
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
6. Reservoir elevation 461.8 m does not consider realignment.

Legend

- Highway 29 Realignment
- Revised Dry Creek Bridge Design
- Pier
- Abutment
- Maximum Normal Reservoir Level (461.8 m)

1:5,000

0 100 200 m

BC Hydro

Figure 3: General arrangement of Highway 29 realignment segment at Dry Creek, per proposed revised bridge design (proposed Figure 4.29 Rev 1)

Date	Dec 4, 2019	DWG NO	1016-C14-B6158-15	R 1

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

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Figure 4: Profile of Dry Creek Crossing, per EIS Design (not to scale)

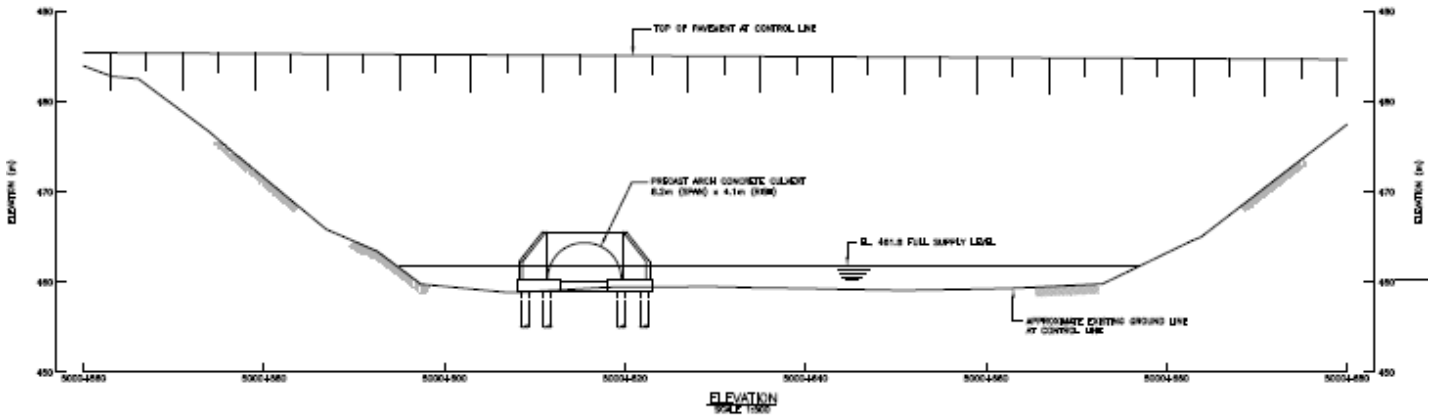
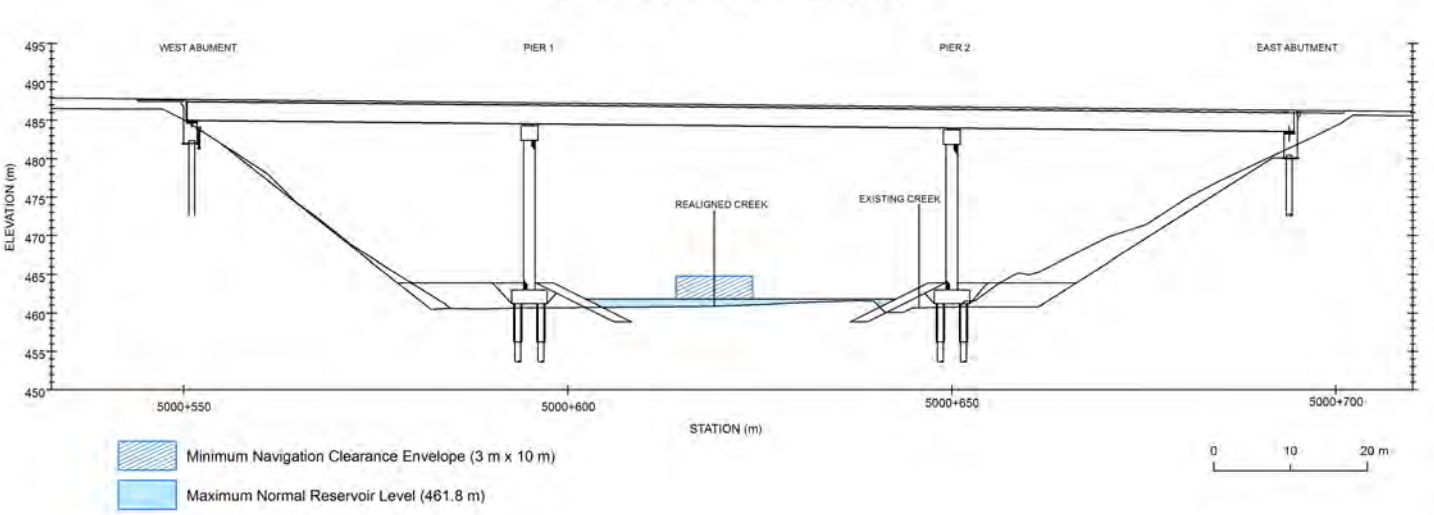


Figure 5: Profile of Dry Creek Crossing, per proposed revised design (not to scale)



Dry Creek Crossing -
EIS Design

N

Dry Creek

EIS Dry Creek Crossing

29

Peace River

Dry Creek Bridge -
Revised Design

N

Dry Creek

Revised Dry Creek
Bridge Design

29

Peace River

Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
6. Reservoir elevation 461.8 m does not consider highway realignment.

Legend

- Highway 29 Realignment
- Pipe Arch Culvert
- Revised Dry Creek Bridge Design
- Pier
- Abutment
- Culvert Infill
- Maximum Normal Reservoir Level (461.8 m)

1:4,000

0 100 200 m

BC Hydro

Figure 6: Dry Creek Crossing - EIS Design vs Revised Design

Date	Feb 10, 2020	DWG NO	1016-N11-00752	R 0

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

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BC Hydro
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Appendix C

Supporting Information for Proposed Revised Design
Lynx Creek Crossing

1. PROPOSED AMENDMENTS TO EIS TABLE 4.5

The location of the Highway 29 crossing at Lynx Creek is shown on Appendix B, Figure 1.

For the Highway 29 crossing at Lynx Creek, BC Hydro is proposing to modify the causeway and bridge described in the EIS to a causeway and bridge that will be 30m and 20m longer respectively. BC Hydro is therefore proposing the following revisions to EIS Section 4.3.4.1, Table 4.5:

Component	EIS Text	Proposed Revisions to EIS Text
Highway 29 Realignment Lynx Creek	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Lynx Creek: Total Length of Segment: 8.0 km Causeway Length: 290 m Bridge Length: 160 m Number of Piers: 1 Number of Bridge Spans: 2 Figure Number: Figure 4.28 Rev 0 (attached as Appendix C, Figure 2)	Section 4.3.4.1, Table 4.5: Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths For Lynx Creek: Total Length of Segment: **8.0 km** Causeway Length: **up to 290 m** Bridge Length: **up to 180 m** Number of Piers: **up to 3** Number of Bridge Spans: **up to 4** Figure Number: **Figure 4.28 Rev 1** (attached as Appendix C, Figure 3)

As shown in Figures 2, 3 and 6, the proposed design changes to the Lynx Creek crossing will not materially change the alignment of the crossing, with the proposed revised alignment a few degrees offset from the EIS alignment. The height of the causeway for the proposed revised crossing has been lowered, resulting in a design requiring additional excavation within the vicinity of the crossing. This excavation will take place within the area of disturbance as assessed for the EIS. In addition, this excavation would be used in the causeway construction, thereby reducing the need to haul material from external sources for construction.

2. LYNX CREEK BRIDGE CONSTRUCTION

Typical bridge construction practices, including the use of temporary laydown areas off the ends of the bridge, may be developed by the contractor to facilitate highway and bridge construction. Material required for highway embankments will be sourced locally from areas that will be inundated by the future reservoir and, potentially, from future areas that will not be inundated by the future reservoir. A concrete batch plant may be setup to produce concrete for the Lynx Creek bridge. Steel piles and girders required in the bridge construction will be manufactured at, and delivered from, off-site facilities. Early in the construction of the Lynx Creek bridge, approximately 250 m of the existing Lynx Creek channel will be bermed and armored to contain the creek to a defined channel, and facilitate construction of granular berms at the base of the west and east slopes of the Lynx Creek valley. These containment berms will be in-place until reservoir filling, currently scheduled for September 2023. Although it is not anticipated at this time, should conditions change during the progression of design and through the course of construction, a temporary creek diversion may be required to facilitate the construction.

3. IMPACT TO VALUED COMPONENTS

The differences between the proposed revised design and the design described in the EIS are not anticipated to cause any adverse effects on valued components beyond the effects that were considered and approved during the environmental assessment of the Project. For this assessment, the following valued components were reviewed and are described below: fish and fish habitat, vegetation and ecological communities, wildlife resources, harvest of fish and wildlife resources, current use of lands and resources for traditional purposes, navigation, and heritage resources. These valued comonents are reflected in seven Decision Statement Conditions:

- Condition 8 – fish and fish habitat, including identification of impacts to navigation
- Condition 9 – disturbance and destruction of migratory birds
- Condition 10 – non-wetland migratory bird habitat
- Condition 11 – wetlands used by migratory birds and for current use of lands and resources for traditional puproses
- Condition 14 – current use of land and resources for traditional purposes
- Condition 15 – archaeological and heritage resources
- Condition 16 – species at risk, at risk and sensitive ecological communities and rare plants

The following valued components were not assessed as they were determined to not interact either with the Highway 29 realignment or with the proposed revised design change to the Farrell Creek crossing: greenhouse gases, local government revenue, labour market, regional economic development, agriculture, forestry, oil, gas and energy, outdoor recreation and tourism, visual resources, population and demographics, housing, community infrastructure and services, transportation, and human health.

The assessment is supported by information in Figures 4 and 5 – the EIS and Revised Design bridge profiles -- and Figure 6, a plan view of the EIS bridge design versus the proposed revised design, post reservoir filling.

Fish and Fish Habitat (Condition 8)

The effects of the Project on fish and fish habitat were assessed in the environmental assessment by considering changes to fish habitat, fish health and survival, and fish movement. As described in the EIS, the section of Lynx Creek adjacent to the realignment provides rearing and feeding habitats for sucker and minnow species, and acts as a migration corridor for fish moving between the Peace River and spawning and rearing habitats further upstream. The EIS concluded that the construction of the Highway 29 realignment at Lynx Creek would not result in a potential loss of fish habitat. The EIS also concluded that the construction of Highway 29 realignments would not result in adverse residual effects on fish health and survival or fish movement if mitigation measures, such as erosion and sediment control, are implemented.

The proposed revision to the Lynx Creek Bridge design is not expected to cause any additional effects on fish and fish habitat beyond those predicted in the EIS. Both the EIS bridge design and the proposed revised design crossing at Lynx Creek at a location that will be converted from stream to reservoir habitat following reservoir filling. Both the causeway and bridge lengths for both the EIS design and the revised design are similar, with the bridge potentially being longer by 20 m. Both the EIS and revised crossing designs have piers located outside the present Lynx Creek channel.

For the revised design, the existing creek will be bermed and armoured to contain the creek to the channel. This armouring will isolate works around the piers from flowing water, and reduce risks to erosion and sediment control. A similar channel would have been required for construction fo the EIS design. The proposed armouring of the channel will continue to allow fish passage to habitat upstream of the bridge crossing before the area is inundated by the future reservoir.

Final design details are pending for the proposed revised bridge. A detailed assessment of the instream impacts of the final bridge design will be undertaken by a qualified environmental professional prior to construction of the bridge, in accordance with the federal *Fisheries Act*.

Vegetation and Ecological Communities and Wildlife Resources (Condition 8, 9, 10, 11 and 16)

The effects of the Highway 29 realignment on vegetation and ecological communities were assessed as part of the assessment of the effects of the Project on vegetation and ecological communities. That assessment focused on the key indicators of terrestrial ecosystems and rare plants. The effects of the Project on terrestrial ecosystems and rare plants were determined in the EIS to be significant due to Project impacts on rare ecological communities and rare plants.

The effects of the Highway 29 realignment on wildlife resources were assessed as part of the effects of the Project on wildlife resources. That assessment focused on a number of wildlife key indicators under the species groups of butterflies and dragonflies, amphibians and reptiles, migratory birds, non-migratory game birds, raptors, bats, fur-bearers, ungulates, and large carnivores. The effects of the Project on wildlife resources were determined to be significant due to the alteration and fragmentation of habitat for avian species of provincial and federal conservation concern.

The proposed revision to the Lynx Creek crossing design is not expected to cause any additional effects on vegetation and ecological communities or wildlife resources beyond those predicted in the EIS. Both the causeway and bridge lengths for both the EIS design and the revised design are similar, with the revised bridge potentially being longer by 20 m. The revised design is expected to result in less disturbance to terrestrial habitat than the EIS design. Therefore, no additional impact on sensitive ecological communities or wildlife habitat is anticipated beyond what has been assessed in the EIS.

Harvest of Fish and Wildlife Resources (Condition 14)

Project effects on the harvest of fish and wildlife resources were assessed in the EIS by considering Project changes to the use of and access to hunting, fishing, trapping, and guide outfitter areas, tenure areas, or the availability of harvested species based on the results of the assessment of the Project on fish and wildlife resources. Because the proposed revised design of the Lynx Creek Bridge will not result in any additional effects on fish and fish habitat, vegetation and ecological communities, and wildlife resources, it is not expected to cause any additional effects on the harvest of fish and wildlife resources beyond those predicted in the EIS.

Current Use of Lands and Resources for Traditional Purposes (Condition 14)

Project effects on Current Use of Lands and Resources for Traditional Purposes were assessed in the EIS by considering Project changes to current use of lands and resources for hunting, fishing and trapping activities, as well as current use of lands and resources for activities other than hunting, fishing and

trapping by Indigenous groups, including cultural activities. The revised design of the Lynx Creek Bridge will result in reduced interactions with fish and fish habitat, and will not result in any additional effects on vegetation and ecological communities or wildlife resources. In addition, the revised design is not expected to result in any additional effects on activities other than hunting, fishing or trapping by Indigenous groups, including cultural activities. Therefore, the revised design is not expected to cause any additional effects on the current use of lands and resources beyond those predicted in the EIS.

Navigation (Condition 8)

The proposed modification to the Lynx Creek Bridge design is not expected to result in any additional effects on navigation beyond those predicted in the EIS. The Lynx Creek Bridge design in the EIS includes a pier and a minimum navigation clearance envelope equal to 8m high (as measured from maximum normal reservoir elevation, 461.8m), and 25m wide. During the environmental assessment, Transport Canada provided an analysis that resulted in the recommendation that the Lynx Creek Bridge design contain a clearance envelope that is 8m high, as measured from the 461.8m reservoir elevation level, and 25m wide.[8] The proposed revised bridge design meets these requirements.

Navigation channel marks and boater notifications for the revised bridge would meet all requirements for compliance under the *Canadian Navigable Waters Act*. Boater access during the construction phase was described in the EIS, including the Lynx Creek boat launch. No restrictions to boater access are expected to result from the changes to the design.

Heritage Resources (Condition 15)

A comprehensive Effects Assessment for Heritage Resources was undertaken for the EIS (see EIS Volume 4 Appendix C, Technical Appendix: Heritage Resource Assessment Report). Information and data for the Effects Assessment was drawn from 1) literature reviews, including palaeontological resources, archaeological resources, and historical resources, 2) consultation between BC Hydro and Indigenous groups, and 3) an extensive, multi-year field inventory and survey.

The proposed revision to the Lynx Creek Bridge design is not expected to cause any additional effects on heritage resources because the footprints of the original and the new designs are both entirely contained within the area previously considered and assessed for heritage resources. There are no known archaeology sites in conflict with the bridge footprint. All Archaeological Impact Assessment and Systematic Data Recovery (SDR) required for the Lynx Creek highway segment has been completed to Project and Heritage Conservation Act Permit standards.

4. GOVERNMENT APPROVALS/ENDORSEMENTS

On February 4, 2020, BC Hydro submitted a request to amend EAC #E14-03, Section 4.3.4.1, Table 4.5, regarding Highway 29 Design at Farrell, Dry and Lynx Creeks.

BC Hydro will be submitting applications for the following permits and approvals related to the Highway 29 realignment at Lynx Creek:

- *Land Act* Licence of Occupation (planned application date December 2019)

[8] https://projects.eao.gov.bc.ca/api/document/58868f2fe036fb0105767ecf/fetch

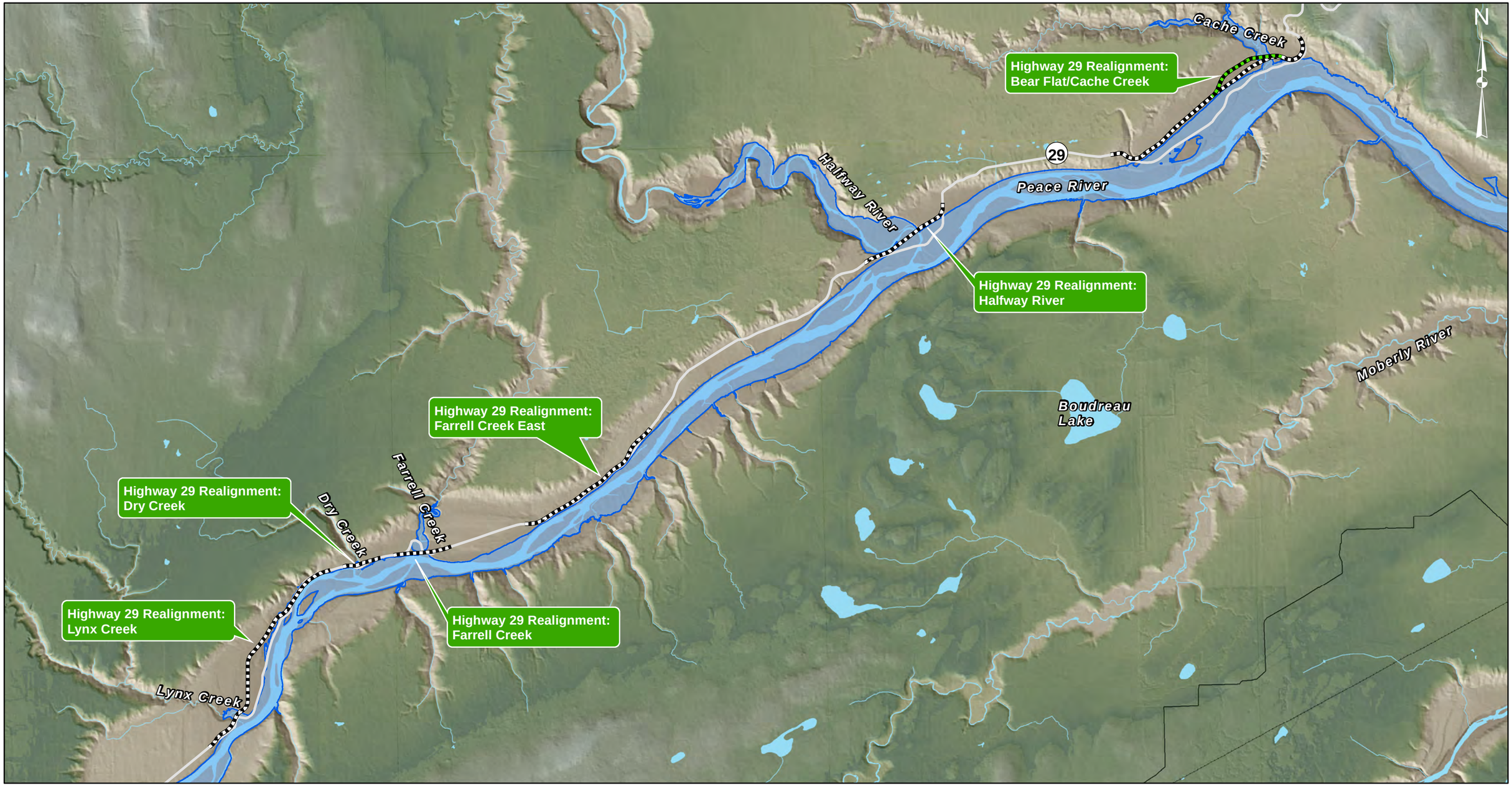
- *Forest Act* Occupant Licence to Cut (planned application date December 2019)
- *Water Sustainability Act* Section 11 Approval for instream works (planned application date December 2019)
- *Water Sustainability Act* Section 10 Approval Short Term Use (planned application date December 2019)
- *Canadian Navigable Waters Act* Approval or Notice of Work (planned application date December 2019)

In addition, an assessment by a Qualified Environmental Professional of potential impacts to fish and fish habitat will be undertaken in accordance with the federal *Fisheries Act.*

5. ATTACHMENTS

Appendix A: Figures

- Figure 1: Location of Lynx Creek Highway 29 realignment segment
- Figure 2: General arrangement of Highway 29 realignment segment at Lynx Creek, per EIS Design (Figure 4.28 Rev 0)
- Figure 3: General arrangement of Highway 29 realignment segment at Lynx Creek, per proposed revised design (proposed Figure 4.28 Rev 1).
- Figure 4: Profile of Lynx Creek Bridge, per EIS Design (not to scale)
- Figure 5: Profile of Lynx Creek Bridge, per proposed revised design (not to scale)
- Figure 6: Lynx Creek Bridge - EIS Design versus Revised Design



Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.
5. Highway design in progress and subject to change.

Legend

- Proposed Highway 29 Realignment
- Approved Highway 29 Realignment
- Highway 29
- Proposed Reservoir

1:134,000 0 1.5 3 6 km

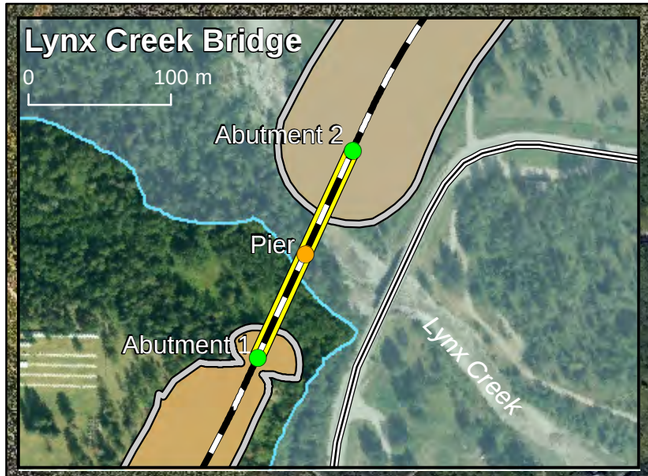
BC Hydro

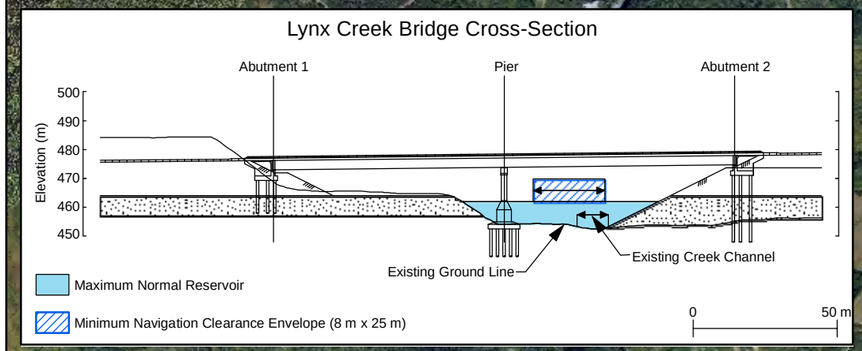
Figure 1: Location of Highway 29 realignment segments

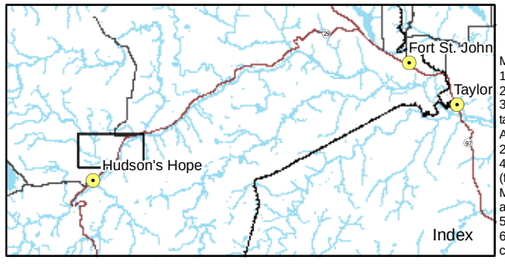
Date	Dec 9, 2019	DWG NO	1016-N11-00712	R 0

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

Path: X:\ArcGIS\Projects\Regulatory\EAC_Amend\Overview_HwyRealign_EAC_1016_N11_00712.mxd







Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos created from 1:40,000 photos taken Sept10th 2007; 1:15,000 photos taken Aug 26, 2011; 1:5,000 photos taken Aug 26, 2011; TRIM
4. Proposed maximum normal reservoir level (full supply level-461.8 m) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/Aug 2006.
5. Realignments subject to change.
6. Reservoir elevation = 461.8 m does not consider realignments.

Legend

- Highway 29 Realignment
- Proposed Bridge
- Road Embankment
- Pier
- Abutment
- Maximum Normal Reservoir Level (461.8 m)
- Existing Highway 29

1:34,000

0 1 km

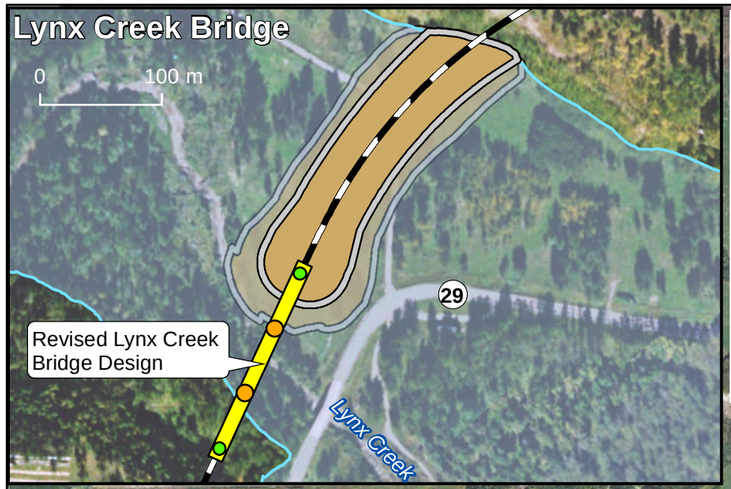
BC hydro

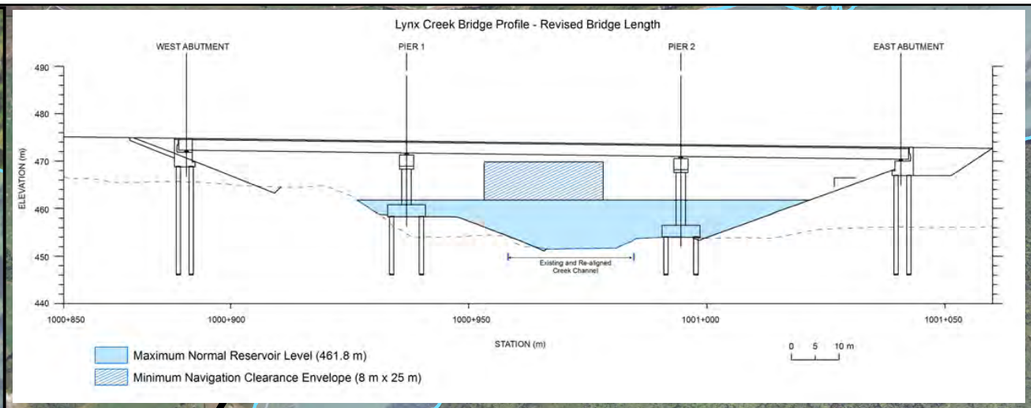
SITE C CLEAN ENERGY PROJECT

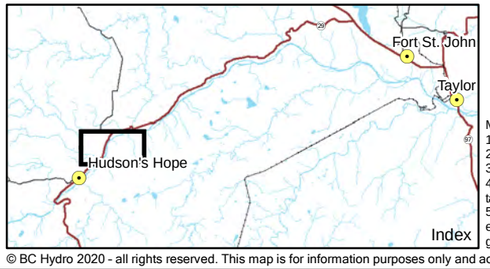
Figure 4.28
General arrangement of Highway 29 realignment segment at Lynx Creek

Date	Nov. 23, 2012	DWG NO	1016-C14-B6158-14	R 0

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







Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007;
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.

Legend

- Highway 29 Realignment
- Revised Lynx Creek Bridge Design
- Pier
- Abutment
- Causeway
- Maximum Normal Reservoir Level (461.8 m)

1:31,500 0 150 300 m

BC Hydro

Figure 3: General arrangement of Highway 29 realignment segment at Lynx Creek, per proposed revised bridge design (proposed Figure 4.28 Rev 1)

Date	Feb 3, 2020	DWG NO	1016-C14-B6158-14	R 1

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

Path: X:\ArcGIS\Projects\Regulatory\EAC_Amend\LynxCreek\LynxCreek_HwyRealign_EAC_1016_C14_B6158-14.mxd

Figure 4: Profile of Lynx Creek Bridge, per EIS Design (not to scale)

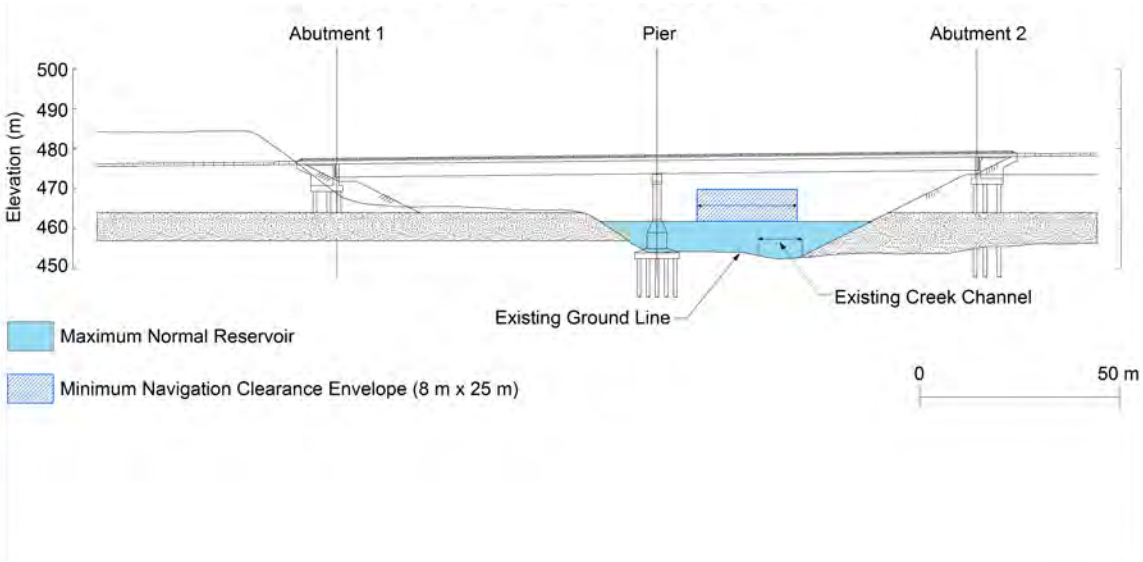
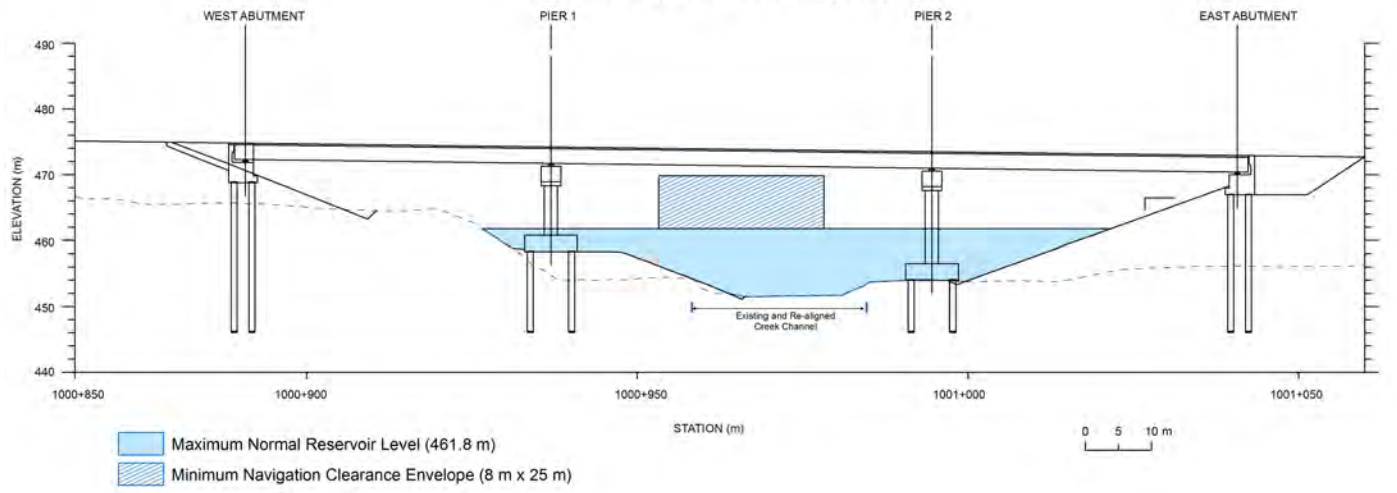


Figure 5: Profile of Lynx Creek Bridge, per proposed revised design (not to scale)



Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Base Data: Province of B.C.
4. Orthophotos created from 1:40,000 photos taken Sept 10th 2007; Imagery: © Digital Globe September 19, 2018
5. Proposed reservoir area (461.8m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August, 2006.

Legend

- Highway 29 Realignment
- EIS Lynx Creek Bridge
- Revised Lynx Creek Bridge Design
- Pier
- Abutment
- Maximum Normal Reservoir Level (461.8 m)

1:4,000 0 100 200 m

BC Hydro

Figure 6: Lynx Creek Bridge - EIS Design vs Revised Design

Date	Feb 10, 2020	DWG NO	1016-N11-00753	R 0

Construction of the Site C Clean Energy Project is subject to required regulatory and permitting approvals.

Path: X:\ArcGIS\Projects\Regulatory\EAC_Amend\LynxCreek\LynxCreek_HwyRealign_IAA_1016_N11_00753.mxd

BC Hydro
Power smart

Appendix D
Proposed changes to EIS in redline (page 4-113)

terraces or along the existing river channel, which would increase the length of the cables. There are a number of locations where the width of the valley floor is either insufficient to lay the cables or to avoid high banks, where slope stability and erosion would pose a risk to the reliability of the lines. These locations include: river kilometer 45 to 46, Attachie, and river kilometer 84 to 85.

- The transmission line would have to be completed prior to reservoir filling so that it would be ready to accept power when the generating station is commissioned and enters into service. Delays to the in-service date so that the cables could be laid from the reservoir surface would cost in the order of hundreds of millions of dollars, due to accumulated interest, and would not be an economically feasible option. The cables would be laid on dry land (e.g., on terraces) prior to reservoir filling, except where it would be necessary to lay the cables in the river to avoid the slope issues described above. Submarine cables are typically laid at sea or on large lakes by specialized cable laying vessels. Since the Peace River in British Columbia is not navigable for large vessels, it would not be possible to use such a vessel for Site C. Therefore, the in-river portion of the cables would have to be laid by a barge fabricated from modular units that could be shipped by road or rail.
- Road and rail capacity would limit the spool diameter and the length of cable that could be transported to the site for laying by barge or on land. This would require multiple cable splices, which would decrease the reliability of the cables.

In summary, the alternative of connecting Site C to Peace Canyon substations through submarine cables is uneconomic, with higher risks and lower reliability.

4.3.4 Highway 29 Realignments

4.3.4.1 General Description

Highway 29 connects Hudson's Hope to Fort St. John and runs along the north side of the Peace River. It is a two-lane rural arterial undivided highway under the jurisdiction of the BC Ministry of Transportation and Infrastructure (BCMOTI).

Segments of the highway would be flooded by the Site C reservoir, resulting in the need to realign approximately 30 km of existing highway at Lynx Creek, Dry Creek, Farrell Creek, Halfway River, and Cache Creek. A section east of Farrell Creek that would not be flooded by the reservoir would need to be relocated further away from the reservoir shoreline due to the effects of long-term erosion and potential instability (see Volume 2 Appendix B Geology, Terrain Stability, and Soil, Part 2 Preliminary Reservoir Impact Lines). The alignments, including bridge cross-sections, are shown on Figure 4.28 through Figure 4.33. The lengths of each segment of the highway relocation, including causeway and bridge lengths, are given in Table 4.5.

Table 4.5 Highway 29 Realignment Segments and Respective Watercourse Crossing Lengths

Segment	Total Length of Segment (km)	Causeway Length (m)	Bridge Length (m)	Number of Piers	Bridge Span	Figure Number
Lynx Creek	8.0	~~290~~up to 290 m	~~160~~up to 180 m	~~1~~up to 3	~~2~~up to 4	Figure 4.28 Rev 1
Dry Creek	1.5	~~N/A~~0	~~11 m pipe arch culvert~~up to 200 m	~~1~~up to 3	~~N/A~~up to 4	Figure 4.29 Rev 1
Farrell Creek	2.0	~~150~~0	~~170~~up to 450 m	~~N/A~~up to 6	~~2~~up to 7	Figure 4.30 Rev 1
Farrell Creek East	6.0	N/A	N/A	N/A	N/A	Figure 4.31
Halfway River	3.7	0	up to 1,042	12	13	Figure 4.32, Rev 2
Cache Creek	up to 9.0	N/A	up to 700	up to 8	up to 9	Figure 4.33 Rev 1 and 4.33 Rev 1 – Detail

NOTE:
N/A – not applicable

Where required, navigable clearance envelopes would be 8 m high by 25 m wide.

Existing local roads within the realigned segments would be connected to the new highway alignment. Private and commercial driveways would be re-established. Driveway locations would be determined in consultation with private property owners and to the approval of BCMOTI.

4.3.4.2 Alternative Highway Alignments Considered

A number of highway alignment alternatives were developed for each of the segments. A multiple account evaluation process was undertaken to evaluate the alternatives for each segment. Characteristics evaluated included the relative safety, environmental effects (including those on fish, wildlife, and habitat), social effects (including those on property, heritage, and agriculture), and costs of each alternative. The process included workshops in which the characteristics of each alternative were ranked. Workshop participants included representatives of BC Hydro, the Site C Integrated Engineering Team, BCMOTI, and highway design consultants.

Each alignment had two options for crossing the watercourse:

- A short bridge plus a causeway
- A long bridge

BCMOTI preferred the short bridge options due to lower long-term maintenance costs, so the long bridge options were dropped.

4.3.4.2.1 Lynx Creek Alternatives

Four alignments for the Lynx Creek section were initially considered (BC Hydro, 2009). During public consultation in 2008, property owners expressed a preference for using the existing Millar Road, so two additional alignments using Millar Road were added.

The alignments considered were:

- Three in an inland corridor, located along the toe of the slope along the west side of the terrace
- One along the reservoir
- Two in a central corridor using a portion of Millar Road

The alignment shown in Figure 4.28 was selected as the preferred alternative. Even though it would have higher cost than the next highest ranked alternative, which was in the inland corridor, this alignment would:

- Utilize a portion of the existing Millar Road alignment and therefore reduce requirements for private property
- Affect fewer fields and a relatively small forested area, resulting in reduced potential adverse effects on the natural habitat
- Require minimal to no in-stream works on the Lynx Creek segment and therefore would have minimal adverse effects on aquatic or riparian habitat
- Have lower potential for collisions between vehicles and wildlife
- Have lower potential agricultural effects

4.3.4.2.2 Halfway River

Three alignments for the Halfway River section were considered (BC Hydro 2009). The overriding design consideration at Halfway River is the potential effect of a landslide-generated wave (see Volume 2 Appendix B Geology, Terrain Stability, and Soil, Part 2 Preliminary Reservoir Impact Lines), which affects the vertical road alignment and the design of the bridge.

The alignments considered were:

- One inland. located along the toe of the slope on the west side of the terrace
- One along the reservoir shoreline
- One using the inland alignment north of the river, crossing the river at an angle, and using the reservoir shoreline alignment south of the river

The alignment shown in Figure 4.32 was selected because it was the lowest overall cost and was considered to have a reasonable balance between the environmental and social factors.

4.3.4.2.3 Cache Creek

Two alignments for the Cache Creek section were considered (BC Hydro 2009). The alignments considered were:

- One along the reservoir shoreline
- One inland located along the toe of the slope on the west side of the terrace

The alignment shown in Figure 4.33 was selected because it has:

- Lower cost

- Less private land requirements
- Less severed actively farmed land
- Less agricultural land required for the right-of-way
- Fewer geotechnical issues

4.3.5 Quarried and Excavated Construction Materials

4.3.5.1 General Description

A variety of quarried and excavated materials would be required for construction of the dam, generating station and spillways, Highway 29 realignments, access roads and the Hudson's Hope shoreline protection. These materials would be sourced from various locations in the Project vicinity, as shown in Figure 4.11.

In the following descriptions, off-site materials refers to materials that are excavated at and transported from a location away from the construction site (off-site) to the site where the materials would be used to construct a Project component. Except where noted otherwise, off-site materials would be transported from the sources to the construction sites by highway-rated trucks on public roads.

In the following descriptions, on-site materials refers to materials that would be sourced at the construction site, and come from excavations required for construction of the Project component or from a location within the boundaries of the site.

The approximate quantities of material to be used in the Project from each source are shown in Table 4.6 and Table 4.7. The quantities of unsuitable and surplus materials are shown in Table 4.8 and Table 4.9. The volume of unsuitable material and the total volume excavated may vary depending on the yield of the quarries, thickness of topsoil, occurrence of zones of material with gradations or moisture contents outside of the required specifications, and the like. For the purpose of the environmental assessment, reasonable but conservative assumptions (i.e., to give higher quantities) have been made.

4.3.5.2 Off-Site Sources

Development plans for the following off-site quarry and excavated materials sources describing the locations, boundaries and haul routes are provided in the following parts of Volume 1 Appendix C Draft Construction Materials Development Plans:

- Part 1 – Impervious Till Core Material Source Development Plan (85th Avenue Industrial Lands)
- Part 2 – Wuthrich Quarry Development Plan
- Part 3 – West Pine Quarry Development Plan
- Part 4 – Portage Mountain Quarry Development Plan
- Part 5 – Del Rio Pit Development Plan

The dimensions of the quarries and the excavated materials sources will depend on the method of development adopted by the contractors. Refer to the quarry and excavated materials development plans for potential development methods and dimensions.