BC Hydro
Power smart

Site C Clean Energy Project Agriculture Monitoring and Follow-up Program

Site C Clean Energy Project

Revision: December 22, 2015

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Acronyms

AMAFP	Agriculture Monitoring and Follow-Up Program
EAC	Environmental Assessment Certificate
EIS	Environmental Impact Statement, Site C Clean Energy Project
The Project	Site C Clean Energy Project
VC	Valued Component

Revision History

Version	Date	Comments
Draft	10-23-2015	Draft
Revision 1	12-22-2015	Final Plan

1.0 Agriculture Monitoring and Follow-up Program

This Agriculture Monitoring and Follow-up Program ("AMAFP") has been developed and must be implemented in accordance with Condition 31 of Environmental Assessment Certificate #14-02, dated 14 October 2014 (the EAC), which was issued in respect of the Site C Clean Energy Project (the Project).

Monitoring plans within this program include:

- Wildlife Habitat Utilization Monitoring **(Appendix A)**
- Monitoring Potential Effects on Crop Drying **(Appendix B)**
- Monitoring Potential Groundwater Effects **(Appendix C)**
- Monitoring to Estimate Irrigation Water Requirements **(Appendix D)**

2.0 Background

The environmental assessment of the Project has been carried out in accordance with the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), the *BC Environmental Assessment Act* (BCEAA), and the Federal-Provincial *Agreement to Conduct a Cooperative Environmental Assessment, Including the Establishment of a Joint Review Panel of the Site C Clean Energy Project*.

On October 14, 2014, the Provincial Ministers of Environment and of Forests, Lands and Natural Resource Operation issued an Environmental Assessment Certificate setting conditions under which the Project can proceed. On November 25, 2014, The Minister of Environment of Canada issued a Decision Statement that sets out the conditions under which the Project can proceed

Background on the Environmental Assessment of the Project is provided in **Appendix E**, and includes the following sections:

- Environmental Impact Statement Findings and Conclusions
- Consultation
- Regulatory Context

3.0 Agriculture Monitoring and Follow-up Program

3.1 Objective and Scope

The agricultural monitoring and follow-up programs were proposed by BC Hydro in Section 20.7 of the EIS (July 2013) where the creation of the reservoir may result in site-specific changes that may affect agricultural operations on individual farm operations, and where project effects on agricultural operations are not already addressed under agreements with BC Hydro. The agricultural monitoring and follow-up programs were included in the Site C Environmental Assessment Certificate as Condition #31. The monitoring program results are to confirm if a Project change has occurred, and to specify the adverse effect on agricultural operations.

The objective of the AMAFP is to set out the monitoring and reporting required by Condition 31 of the EAC. In particular, in this AMAFP, the requirements for the following are set out:

- Monitoring for Project-induced changes in wildlife habitat utilization, and evaluation of associated crop or feed storage damage for, agricultural operations within 5 km of the

reservoir, to assess if there is an increase in wildlife-related crop depredation due to Project-related habitat losses. Monitoring will include pre- and post-reservoir filling field surveys, wildlife monitoring, farm operator interviews, and analysis of relevant records related to wildlife-related crop depredation.

- Monitoring for Project-induced changes to humidity within 3 km of the reservoir, and evaluation of associated effects on crop drying within this area. Monitoring will include collection and analysis of climate data, calculation of crop drying indices, and farm operator interviews.
- Monitoring for Project-induced changes to groundwater elevations within 2 km of the reservoir (the area potentially influenced by groundwater elevation changes), and evaluation of associated effects on crop productivity. Monitoring will include field surveys and farm operator interviews.
- Monitoring for climatic factors to estimate moisture deficits and to estimate irrigation water requirements in the vicinity of the reservoir to provide information for potential future irrigation projects. Data collection will be undertaken before reservoir filling, and in the 5 years after reservoir filling, and data will be reviewed as required for proposed irrigation projects.

As per Condition 31, the Agriculture Monitoring and Follow-up Program reports will be provided annually during the monitoring and follow-up period to affected agricultural land owners and tenure holders, and the Ministry of Agriculture. If adverse effects are identified in the results of the agricultural monitoring plans for Wildlife Habitat Utilization, Reservoir Induced Effects on Crop Drying, and Groundwater Effects, the data and analysis will be used to inform individual Farm Mitigation Plans.

Results from the Monitoring to Estimate Irrigation Water Requirements Plan will be used to support future decisions regarding irrigation improvements, including in support of potential projects that may be proposed under the agricultural compensation program.

In Table 3.1 the requirements of EAC Condition 31 and the section of this program that describes how the requirement will be met are set out.

Table 3.1: Environmental Assessment Certificate Condition and Plan Reference

EAC Condition Number	Requirement	Plan Reference
AGRICULTURE		
31	In addition to and separate from the compensation funding and mitigation funding the EAC Holder must fund and develop an Agriculture Monitoring and Follow-up Program for a 10 year period which includes the five years prior to reservoir filling and the first five years of operation.	

EAC Condition Number	Requirement	Plan Reference
31	The Agriculture Monitoring and Follow-up Program must include at least the following:	
	Monitoring for Project-induced changes in wildlife habitat utilization, and evaluation of associated crop or feed storage damage for, agricultural operations within 5 km of the reservoir, to assess if there is an increase in wildlife-related crop depredation due to Project-related habitat losses. Monitoring must include pre- and post- reservoir filling field surveys, wildlife monitoring, farm operator interviews, and analysis of relevant records related to wildlife-related crop depredation.	This requirement is addressed in Mon-A Wildlife Habitat Utilization Monitoring Plan provided in AMAFP Appendix A.
	Monitoring for Project-induced changes to humidity within 3 km of the reservoir, and evaluate associated effects on crop drying within this area. Monitoring must include collection and analysis of climate data, calculation of crop drying indices, and farm operator interviews.	This requirement is addressed in Mon-B Monitoring Potential Effects on Crop Drying Plan provided in AMAFP Appendix B.
	Monitoring for Project-induced changes to groundwater elevations within 2 km of the reservoir (the area potentially influenced by groundwater elevation changes), and evaluate associated effects on crop productivity. Monitoring must include field surveys and farm operator interviews.	This requirement is addressed in Mon-C Monitoring Potential Groundwater Effects Plan provided in AMAFP Appendix C.
	Monitoring for climatic factors to estimate moisture deficits and to estimate irrigation water requirements in the vicinity of the reservoir to provide information for potential future irrigation projects. Data collection will be undertaken before reservoir filling, and in the 5 years after reservoir filling, and data will be reviewed as required for proposed irrigation projects.	This requirement is addressed in Mon-D Monitoring for Climatic factors to estimate moisture deficits Plan provided in AMAFP Appendix D.
	The Agriculture Monitoring and Follow-up Program reports must be provided annually during the monitoring and follow-up period to affected agricultural land owners and tenure holders, and Ministry of Agriculture.	This requirement is addressed in Section 6 of this AMAFP, Implementation and Reporting.
	The results of the Agriculture Monitoring and Follow-up Program must inform the Farm Mitigation Plans.	This requirement is addressed in Section 6 of this AMAFP Implementation and Reporting.

EAC Condition Number	Requirement	Plan Reference
	Reporting must begin 180 days after the commencement of the monitoring and follow-up program that is to begin 180 days after commencement of construction.	
	The EAC Holder must provide this draft Agriculture Monitoring and Follow-up Program to the Ministry of Agriculture, Peace River Regional District and the District of Hudson's Hope for review within 90 days after the commencement of construction.	
	The EAC Holder must file the final Agriculture Monitoring and Follow-up Program with EAO, Ministry of Agriculture, Peace River Regional District and the District of Hudson's Hope within 150 days of commencement of construction.	
	The EAC Holder must develop, implement and adhere to the final Agriculture Monitoring and Follow-up Program, and any amendments, to the satisfaction of EAO.	

4.0 Agriculture Assessment

The potential effect of the Project on agriculture was assessed in Section 20 of the EIS, as amended (July 2013). The assessment considered the potential for the Project to effect four key aspects of agriculture in the local assessment area including:

- Temporary and permanent loss of agricultural land;
- Changes in individual farm operations, including potential changes to local microclimate that could affect agriculture;
- Changes in agricultural economic activity; and,
- Changes in local and regional food production and consumption.

A summary of the following components of the Agriculture Assessment are included within **Appendix F.**

- Assessment Area
- Baseline conditions
- Potential effects of the project, with a description of changes to agriculture
- Mitigation measures
- Residual effects

The monitoring and follow-up requirements as per EAC Condition 31 were developed based on the findings of the agricultural assessment.

5.0 Overview of Agriculture Monitoring Programs

The AMAFP includes four monitoring plans designed to address Condition 31, as per Table 5.1.

Table 5.1: Individual monitoring plans within the AMAFP

Program	Appendix	Monitoring Program Name and Description
Mon-A	**A**	**Wildlife Habitat Utilization Monitoring** *Monitor changes in wildlife habitat utilization and evaluate associated crop or feed damage for agricultural operations within 5 km of the reservoir.*
Mon-B	**B**	**Monitoring Potential Effects on Crop Drying** *Monitor changes to humidity within 3 km of the reservoir and evaluate associated effects on crop drying within this area.*
Mon-C	**C**	**Monitoring Potential Groundwater Effects** *Monitor changes to groundwater elevations within 2 km of the reservoir and evaluate associated effects on crop productivity.*
Mon-D	**D**	**Monitoring to Estimate Irrigation Water Requirements** *Monitor climatic factors to estimate moisture deficits and to estimate irrigation water requirements in the vicinity of the reservoir to provide information for potential future irrigation projects.*

5.1 Monitoring Plan Format

Each of the four monitoring plans follows a similar layout, which includes three main elements:

- Rationale
    - Background
    - Question and Hypothesis
    - Mitigation and Compensation Questions Affected
- Monitoring Plan
    - Approach
    - Tasks
    - Interpretation of Monitoring Program Results
    - Schedule
- References

The Rationale section provides the background for the monitoring program based on findings presented in the EIS. Questions guiding the plans are provided, along with Hypotheses to be tested. The Monitoring Plan section provides an overview of the objective and scope of the monitoring program, the approach to monitoring, including baseline data, proposed tasks, and schedule. As part of the approach, BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to the monitoring program.

6.0 Implementation and Reporting

EAC Conditions 31 provides, in part, as follows:

- "The Agriculture Monitoring and Follow-up Program reports must be provided annually during the monitoring and follow-up period to affected agricultural land owners and tenure holders, and Ministry of Agriculture. The results of the Agriculture Monitoring and Follow-up Program must inform the Farm Mitigation Plans."

- "Reporting must begin 180 days after the commencement of the monitoring and follow-up program that is to begin 180 days after commencement of construction"

Monitoring, analysis and reporting will be undertaken in accordance with the schedule set out in Table 6.1. In addition, more details regarding implementation are set out in each of the four monitoring plans provided in Appendices A-D.

Table 6.1: AMAFP Schedule

Phase Description	Timeline
Historical data review, Baseline[1] data collection; New climate station siting and installation; Preparations for field survey, consultation and interviews.	• January 2016 – December 2017
Data collection, field surveys, interviews, consultation, and data analysis.	• Five Years Prior to Reservoir Filling (December 2017 - December 2022) • Five Year Post Reservoir Filling (January 2023 - January 2028)
Annual and Final Reporting	• July 2016 – July 2028

BC Hydro will provide annual reports on the implementation of the AMAFP to affected agricultural land owners and tenure holders, and Ministry of Agriculture, beginning on July 21, 2016 (360 days after commencement of construction). These reports will include a summary of monitoring plan implementation activities, and will be submitted annually in July from 2016 to 2028.

7.0 Agriculture Follow-up

The monitoring required under AMAFP will assess depredation, changes in humidity, changes in groundwater, and estimates of irrigation requirements. As required by EAC condition 31, that information will be used to inform the individual Farm Mitigation Plans, to be developed in accordance with EAC Condition 30.

[1] Baseline data refers to the continued collection of data from existing climate stations and monitoring sites. As new stations and sites are added, and additional parameters are included on existing stations, this data will be incorporated into reporting as it becomes available.

8.0 Qualified Professionals

Table 4 lists the qualified individuals who contributed to the preparation and review of the AMAFP.

Table 8.1: Qualified Professionals

Qualified Individual	Expertise
Patrick Brisbin, P.Eng., P.Ag.	Agriculture
K. Anré McIntosh, R.Bio, P.Ag.	Wildlife
Brent Mooder, B.A.Sc., M.Sc., P.Eng.	Hydrogeology
Sarah Simon, B.A.Sc., E.I.T. (BC)	Physical Monitoring

9.0 Process for Revision and Updates

The requirements for monitoring and follow-up provided for in this Program, and within each of the four monitoring plans, will be reviewed by BC Hydro at least once annually. BC Hydro will conduct that review on the basis of further information that will become available as monitoring and follow-up program implementation progresses. Plan revisions and updates will be documented within annual monitoring reports.

10.0 References

BC Hydro. 2013a, *Site C Clean Energy Project Environmental Impact Statement: Section 10 Effects Assessment Methodology*. Table 10.1 Spatial Boundary Descriptors.

BC Hydro. 2013b, *Site C Clean Energy Project Environmental Impact Statement: Section 11.3 Land Status, Tenure and Project Requirements.*

BC Hydro. 2013c. *Site C Clean Energy Project Environmental Impact Statement: Volume 3, Section 20 Agriculture.* Vancouver, BC.

BC Hydro. 2013d. *Site C Clean Energy Project Environmental Impact Statement: Volume 3, Appendix D, Agricultural Assessment Supporting Documentation.* Vancouver, BC.

BC Hydro. 2015. *Vegetation and Wildlife Mitigation and Monitoring Plan, June 5, 2015*. Page 75 "Selection of Land for Compensation Section". Vancouver, BC.

British Columbia (B.C.) Environment and Land Use Committee Secretariat. 1976. Agricultural Land Capability in British Columbia. Victoria, B.C.

Statistics Canada. 2012a. 2011 Census of Agriculture. Available at: http://www.statcan.gc.ca/ca ra2011/index-eng.htm. Accessed: May 2012.

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APPENDIX A: Wildlife Habitat Utilization Monitoring

AGRICULTURE -WILDLIFE HABITAT UTILIZATION MONITORING

SUMMARY

Description	Changes to wildlife habitat utilization and potential damage to crops and stored feed by wildlife in the vicinity of the reservoir will be monitored in accordance with this Plan.
Parameters	Farm operations within 5 km of the reservoir. See Figure 1: Wildlife Habitat Utilization Monitoring Area
Project components	Crop and feed storage damage
Monitoring Category	Status and Trend Monitoring
Timeline	January 2016 to July 2028.

RATIONALE

BACKGROUND

The Site C Clean Energy amended Environmental Impact Statement (BC Hydro. 2013)("EIS") notes the potential for increased wildlife crop damage (Table 20.1) and identifies reservoir induced changes to wildlife presence in agricultural areas as a key indicator (Table 20.3).

EIS Section 20.7.2.1 (page 20-53, lines 12 to 14) states "The loss of wildlife habitat in the reservoir may lead to an increase in wildlife in agricultural areas near the reservoir, which could lead to wildlife damage to crops and stored livestock feed for farm operations."

Condition No. 31 of the Environmental Assessment Certificate states: "the Agriculture Monitoring and Follow-up Program must include monitoring for Project-induced changes in wildlife habitat utilization, and evaluation of associated crop or feed storage damage for, agricultural operations within 5 km of the reservoir, to assess if there is an increase in wildlife-related crop depredation due to Project-related habitat losses. Monitoring must include pre- and post-reservoir filling field surveys, wildlife monitoring, farm operator interviews, and analysis of relevant records related to wildlife-related crop depredation."

In accordance with Condition No. 31 this monitoring plan is intended to determine if there are changes to the extent and severity of wildlife damage to crops and stored livestock feed after reservoir filling.

QUESTION

The question to be addressed by this monitoring plan is whether the effect of reservoir induced changes in wildlife habitat utilization result in increases in damage to crops and stored livestock feed within 5 km of the reservoir.

HYPOTHESIS

The hypothesis to be tested is as follows;

H_0: Reservoir induced changes to wildlife habitat utilization do not increase the extent or severity of wildlife damage to crops and stored livestock feed within 5 km of the reservoir.

The hypothesis will be tested by monitoring the extent and severity of wildlife damage to crops and stored livestock feed. Sources of data to be used to test the hypothesis will include: historical data from the Wildlife Damage Compensation Program; field surveys; and construction and monitoring of several small enclosures to isolate small areas from any wildlife damage to provide a control to assist in estimating crop losses. In addition, interviews will be completed with farm operators within 5 km of the reservoir in areas where changes in wildlife habitat utilization may increase wildlife damage to crops and stored livestock feed.

MITIGATION AND COMPENSATION QUESTIONS AFFECTED

If adverse changes to wildlife damage to crops and stored livestock feed occur as a result of the loss of wildlife habitat attributable to the Project, those changes will be accounted for in individual Farm Mitigation Plans unless they are already addressed under agreements with BC Hydro.

Potential mitigation measures for consideration within individual Farm Mitigation Plans may include:

- Fencing around feed storage areas
- Strategic fencing of feeding areas and fields
- Wildlife habitat enhancement outside of field areas
- Strategic cropping with placement of high value crops away from prime ungulate habitat
- Compensation for documented increases in crop and stored feed damage due to changes in wildlife habitat utilization directly as a result of Site C.

MONITORING PLAN

APPROACH

The plan includes the review of historical records on crop and feed loss due to wildlife, consultation with agencies and interested producer groups, annual field surveys of crop damage, review of ongoing Ministry of Agriculture Wildlife Damage Compensation Program records, and interviews with selected

farm operators of farms within 5 km of the reservoir to estimate the magnitude, if any, of increases in the extent and magnitude of crop losses.

A 5 km study area around the reservoir was proposed as a conservative study area based on discussion with the Ministry of Agriculture. In addition to this study area, potential projects effects will be discussed with directly affected property owners, and as appropriate, agreements for mitigation or compensation may be entered into.

BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan.

TASKS

The objective of this monitoring plan is to collect data necessary to determine whether reservoir induced changes to wildlife habitat utilization increase the extent or severity of wildlife damage to crops and stored livestock feed within 5 km of the reservoir.

The plan will consist of the following steps.

1. Task 1: Project Co-ordination
2. Task 2: Historical review of Ministry of Agriculture's Wildlife Damage Compensation Program records
3. Task 3: Identification of, and invitation to operators of farms within 5 km of the reservoir to participate in annual interviews, and questionnaire preparations
4. Task 4: Annual consultation
5. Task 5: Annual field surveys, and twice annual interviews with farm operators in potentially affected areas
6. Task 6: Data analysis and annual reporting
7. Task 7: Final Reporting

The individual tasks are described in detail below.

Task 1. Project coordination. Project coordination will involve the general administrative and technical oversight of this monitoring plan. This task will be completed for the full duration of the plan. The task will include: 1) budget management, 2) team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer and report submission.

Task 2. Collect Historical Data. Collect and summarize historical data on the extent and severity of wildlife damage to crops and stored livestock feed from the BC Ministry of Agriculture's Wildlife Damage Compensation Program relevant to the Peace River Region, and specifically within 5 km of the reservoir. Summaries of the historical data will include tables and maps showing extent, severity and variability in crop and stored feed damage within 5 km of the reservoir. This task will be completed between January 2016 to December 2016 by the agricultural contractor.

Task 3. Identification of farm operators for interview participation and Field Survey locations. Identify and invite farm operators with farms within 5 km of the reservoir to participate in annual interviews. A map has been prepared titled: Figure 1: Wildlife Habitat Utilization Monitoring Area. This map shows the 5km monitoring study area around the reservoir that will be used to identify farm operations for interviews and working group discussion. Selection of locations for field surveys and selection of operators to be interviewed will be based in part on historical crop loss information and on reports of current crop loss or damage to feed storage areas. Prepare a questionnaire to be used in farm operator interviews. The interview will include questions to gather the following information:

- Location;
- Crop or Feed type;
- History of crop and feed damage; include range, variability, and seasonal timing;
- Cause of damage – wildlife type; and,
- Quantification of severity and extent of damage; estimate of loss to crop or feed (financial and quantity).

Task 4. Consultation. Annual consultation with the Peace River Regional District Wildlife Committee, representatives of key provincial agencies, including the Ministry of Agriculture, Ministry of Environment, and Ministry of Forests, Lands and Natural Resource Operations, and interested producer groups to discuss the monitoring plan, findings, and possible modifications to the plan, as required.

Task 5. Field surveys and interviews. Twice annual field surveys in the five years pre- and post-reservoir filling will be conducted to estimate the quantitative extent and severity of damage to crops at selected locations. Field surveys will be timed in the fall, after potential damage to crops, and in the spring, to observe potential damage to stored feed.

The field surveys will include construction of several small enclosures to isolate small areas from any wildlife damage, to provide a control monitoring location, to assist in estimating crop losses. The enclosure will be erected after seeding in the spring, with all required approvals.

Field surveys will collect the following data/parameters:

- Location of damage;
- Crop type or feed storage type
- Cause of damage – wildlife type
- Severity and extent of damage (estimate of loss of crop or feed)

Selected farm operators in potentially affected areas will be interviewed twice annually each year (2018 – 2028) to collect information on their crop loss experiences. Interviews will be guided by the questionnaire developed as part of Task 2.

Task 6. Annual reporting. For 2016 and 2017 annual reports will summarize historical data collection and consultation. In the 10 years of full plan implementation (5 years pre- and post-reservoir filling)

complete summaries of the collected data and analyses, and of the information collected during interviews with farm operators, will be presented in annual reports. During the 10 year implementation phase the annual reporting will include:

- A summary of the project;
- Maps showing the locations and results of field surveys conducted as part of this plan, the results of crops loss estimates or feed storage loss estimates from the Wildlife Damage Compensation Program, and locations of farms where operators were interviewed;
- Summaries of collected data, and description of analyses and results;
- An assessment of the findings as they relate to the management question; and
- Any recommended changes to the monitoring plan.

Task 7. Final Reporting. At the conclusion of the initial monitoring periods (5 years after reservoir filling) a determination of any effect and of the need for any additional work to assess the issue will be made. These results, along with summaries of the annual reports, will be included in a report which will be submitted to stakeholders as identified in Condition 31.

INTERPRETATION OF MONITORING PLAN RESULTS

As described above, all data collected as part of this plan will be analyzed and interpreted in relation to potential reservoir induced effects on changes in wildlife damage to crops and stored livestock feed with consideration of changes between historical data and findings 5 years pre- and post-reservoir filling.

Changes in the extent and severity of crop losses will be mapped and summarized in tabular format where applicable. The reports will provide a discussion of pre-reservoir filling wildlife damage to crops and stored livestock feed compared to post-reservoir filling damages.

As part of the reporting procedure all data must be submitted in MS Excel format, accompanied with any necessary descriptions and full metadata. Reports will be submitted in MS Word and PDF format.

SCHEDULE

The schedule for this plan is summarized below.

Historical data collection, and Identification of farm operators for interview participation and Field Survey locations (Tasks 1, 2, 3, and 6)	• January 2016 – December 2017
Interviews, Field Surveys, and Analysis (Tasks 1, 4, 5, and 6)	• Five Years Prior to Reservoir Filling December 2017- December 2022 • Five Years Post Reservoir Filling January 2023 - January 2028

Annual and Final Reporting (Tasks 6 and 7)	• July 2016 – July 2028

From January 2016 to December 2017 historical data from the BC Ministry of Agriculture's Wildlife Damage Compensation Program will be collected. In order to conduct consultation, contacts will be identified, questionnaire will be developed, and farm operators within 5 km of the reservoir will be invited to participate in interviews. Identification of field survey locations and enclosure areas will be completed. BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan

Consultation, field surveys and interviews will be completed over 10 years commencing 5 years prior to reservoir filling and ending 5 years after reservoir filling. Results will be analyzed annually and reported within annual reports.

REFERENCES

BC Hydro, 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 2, Section 11.3 Land Status, Tenure, and Project Requirements.

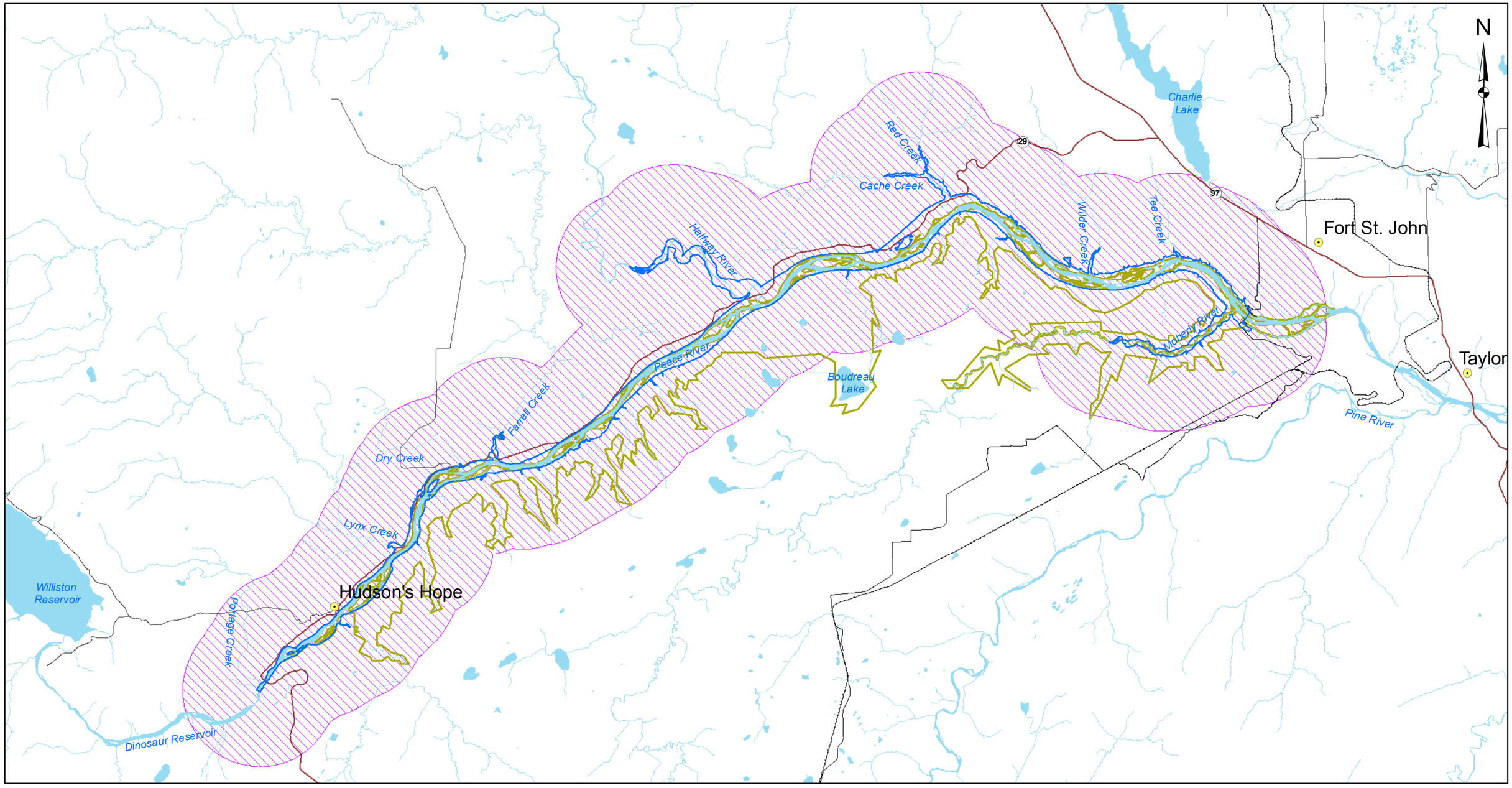
BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Section 20, Agriculture

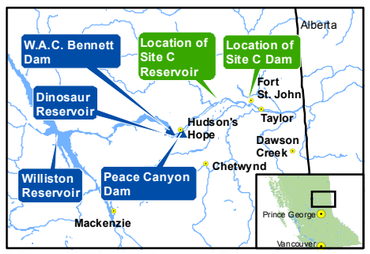
BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Appendix D Agricultural Assessment Supporting Documentation

British Columbia (B.C.) Ministry of Agriculture, 2012. (Personal Communications)

British Columbia (B.C.) Ministry of Forests, Lands and Natural Resource Operations. 2012. (Personal Communications)

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





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.

Legend

- Area to be Considered for Wildlife Habitat Utilization Monitoring
- Proposed Peace River Boudreau Lake Protected Area
- Proposed Reservoir
- Road
- Highway
- Railway

1:250,000

0 5 km

BC Hydro

Figure 1: Wildlife Habitat Utilization Monitoring Area

Date	December 14, 2015	DWG NO	1016-C14-07074	R 0

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

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APPENDIX B: Monitoring Potential Effects on Crop Drying

AGRICULTURE - MONITORING OF RESERVOIR INDUCED EFFECTS ON CROP DRYING

SUMMARY

Description	This study will investigate changes to climate parameters which affect crop drying in the vicinity of the reservoir (within 3 km)
Parameters	Selected locations within 3 km of the reservoir See Figure 1: Climate Stations
Project Components	Climate data including air temperature, humidity, precipitation, solar radiation, wind speed and direction, barometric pressure, net radiation, soil temperature, soil heat flux, and soil water content, and information obtained from interviews with farm operators.
Monitoring Category	Status and Trend Monitoring
Closely related studies	Monitoring to Estimate Irrigation Water Requirements
Timeline	January 2016 to July 2028

RATIONALE

BACKGROUND

The Site C Clean Energy Environmental Impact Statement (BC Hydro. 2013)("EIS") identifies reservoir induced changes to microclimate on adjacent agricultural operations as a key indicator (EIS Section 10, Table 20.3). Effect on crop drying is one reservoir induced change which may occur.

EIS Section 20.3.6 (page 20-50, lines 27 to 36) states "Predicting the effect that the reservoir might have on crop drying is made difficult by the complexity of the effect of the reservoir on several climatic parameters that drive both drying and wetting effects. Generally, the RWDI model predicts increases in humidity up to 15% for stations located closely adjacent to the reservoir during the summer and fall months. The model predicts the effect on humidity during the summer and fall not to be statistically significant for locations not directly adjacent to the reservoir. The RWDI report predicts that effects on fog formation from the reservoir are in the order of 0.5% or less over the year. However, due to increased humidity, the reservoir could potentially have a small effect on crop drying during summer and early fall in the Peace River valley in areas adjacent to the reservoir."

Environmental Assessment Condition No. 31 states the Agriculture Monitoring and Follow-up Program must include monitoring for Project-induced changes to humidity within 3 km of the reservoir, and evaluate associated effects on crop drying within this area. Monitoring must include collection and analysis of climate data, calculation of crop drying indices, and farm operator interviews.

In accordance with Condition No. 31, this study is intended to determine if there are reservoir induced changes to the microclimate on adjacent farms which result in a negative effect on crop drying.

QUESTIONS

The management question to be addressed by the monitoring plan is: What is the effect of the reservoir induced changes to microclimate on crop drying?

HYPOTHESES

The hypothesis to be tested is:

H_0: Reservoir induced changes to microclimate do not adversely affect crop drying.

The hypothesis will be tested by monitoring climate parameters to determine if changes occur, and if these changes have an adverse effect on crop drying indices. Further information will be gathered by interviewing farm operators in areas where crop drying may be adversely affected to obtain information on their crop drying experiences.

MITIGATION AND COMPENSATION QUESTIONS AFFECTED

If changes to climate parameters show that there is an adverse effect on crop drying indices and if information obtained from farm operators indicates increased difficulties in crop drying, then mitigation options will be discussed with affected farm operators and implemented where project effects on agricultural operations are not already addressed under agreements with BC Hydro.

Potential on-farm mitigation and compensation measures for individual farm operations that experience documented changes to microclimate that adversely affect crop drying, which are directly attributable to the reservoir may include:

- Compensation for the costs associated with additional crop drying using crop drying systems
- Compensation for costs associated with alternate harvesting methods (for example, silage rather than hay).

MONITORING PLAN

APPROACH

The plan includes the collection of climate data and information from interviews with operators of farms within 3 km of the reservoir to estimate the magnitude, if any, of adverse effects on crop drying.

The Agricultural section of the Site C Environmental Impact Statement noted that reservoir-induced local climate effects on agriculture are anticipated to be limited to possible effects on crop drying within

1 km of the reservoir. To be conservative in assessing this potential effect, potential effects on crop drying will be assessed for areas within 3 km of the reservoir.

BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan.

TASKS

The objective of this monitoring plan is to address the management question posed by collecting data necessary to draw inferences and to test the management hypothesis. The plan will include the following steps:

1. Task 1: Project co-ordination.
2. Task 2: Confirmation of climate station locations, and identification of and invitations to farm operators to participate in monitoring plan interviews.
3. Task 3: Installation of climate stations at new locations, and retrofit of existing stations within 3 km of the reservoir.
4. Task 4: Maintenance of new and existing climate stations.
5. Task 5: Data collection from climate stations.
6. Task 6: Interviews with potentially affected farm operators to collect information on their crop drying experiences, and engagement with regional producer associations collecting relevant data.
7. Task 7: Data analysis and annual reporting
8. Task 8: Final Reporting

The individual tasks are described below.

Task 1. Project co-ordination. Project coordination will involve the general administrative and technical oversight of this monitoring plan. This task will include: 1) budget management, 2) team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer and report submission.

Task 2. Confirmation of climate station locations, and Identification of farm operators for interview participation. A network of climate stations will be established within 3 km of the reservoir to monitor the influence of the reservoir on crop drying (and irrigation demand, as Monitoring Plan D – Monitoring to Estimate Irrigation Water Requirements). The network will include eight climate stations in the locations identified on *Figure 1 Climate Stations,* included at the end of this plan. The map identifies specific location and general areas for new stations that meet elevation and distance from the reservoir requirements. These station locations have been identified to adequately assess gradients in climate parameters along the reservoir and from the reservoir to the plateau.

The network of BC Hydro climate stations to monitor the influence of the reservoir on crop drying is designed to monitor the climatology in agricultural areas adjacent to, intermediate, and away from the

effects of reservoir boundary conditions predicted by the microclimatic model results presented in the Microclimate Technical Data Report within the EIS (BC Hydro.2013. Volume 2, Appendix K). The microclimatic model predicted the potential for some impact on climate conditions which could affect crop drying in close proximity to the reservoir.

Farm operators within 3 km of the reservoir will be identified and invited to participate in the monitoring plan interviews. A questionnaire will be prepared to be used in the farm operator interviews. The interview will include questions to gather the following information:

- Location (elevation, distance from reservoir)
- Crop type(s)
- History of crop drying: including variability on annual and seasonal basis
- Crop production (yield)

Task 3. Installation of climate stations at new locations and retrofit of existing stations. All eight of the BC Hydro climate stations for this monitoring plan will record the following parameters:

- air temperature
- humidity
- precipitation
- solar radiation
- wind speed
- wind direction
- barometric pressure
- net radiation
- soil temperature
- soil heat flux
- soil water content

Some existing climate stations have the full suite of parameters, while other will need to be retrofitted to meet the requirements of this monitoring plan.

Task 4. Maintenance of climate stations. Climate stations will be maintained at appropriate intervals, and additionally as required.

Task 5. Data collection from Climate Stations. Data from the climate stations will be collected and summarized annually in tabular format, and by location.

Task 6. Interviews with potentially affected farm operators and engagement with regional producer associations. Farm operators within 3 km of the reservoir will be interviewed each year to collect information on their crop drying experiences. Interviews will utilize the questionnaire prepared in Task 2. BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan. BC Hydro is aware that there is an

ongoing project, led by the BC Grain Producers' Association, titled "Peace – Agriculture Weather Monitoring and Decision Support Tools". The objective of this project is to establish a collaborative approach to expanding and maintaining the weather monitoring network within the BC Peace region. Operators of existing weather stations will be invited to participate in a regional data sharing initiative. BC Hydro will contact the BC Grain Producers' Association and is prepared to collaborate and share data with this project.

Task 7. Data analysis and annual reporting. From December 2016 to December 2017, the annual report will summarize climate station siting, interview preparations, and data collection for existing climate stations. In the 10 years of full plan implementation (5 years pre and 5 years post-reservoir filling) complete summaries of the collected data from the new and existing BC Hydro climate stations will be analyzed annually to evaluate crop drying conditions and calculate crop drying indices. The methodology to be followed in calculating the crop drying indices using climate data is described within the *Interpretation of Monitoring Plan Results* section below. Data analysis will include quality assurance and quality control using appropriate methods. Summaries of the collected data and analyses, and of the information collected during interviews with farm operators, will be presented in annual reports.

During the 10 year implementation phase the annual reporting will include:

- A summary of the project;
- Maps showing climate station locations and the locations of farms where operators were interviewed;
- Descriptions of steps taken for quality assurance and quality control;
- Summaries of collected data, and description of analyses and results;
- An assessment of the findings as they relate to the management question; and
- Any recommended changes to the monitoring plan.

Task 8. Final Reporting. At the conclusion of the initial monitoring periods (5 years post-reservoir filling) a determination of any effect and of the need for any additional work to assess the issue will be made. Additional work may be required if the collected climate data does not adequately answer the management question. These results, along with summaries of the annual reports, will be included in a final report and provided to stakeholders as identified in Condition 31.

INTERPRETATION OF MONITORING PLAN RESULTS

As described above, all data collected as part of this plan will be analyzed and interpreted in relation to potential reservoir induced effects on crop drying. Results of the monitoring plan will quantify any changes to climatic factors which influence crop drying. Crop drying indices will be calculated using an appropriate model. These indices will provide data to:

- support analysis of spatial and temporal climatic variability and trends affecting crop drying;
- statistically evaluate the localized effects of the reservoir on crop drying over time; and

- support ongoing management decisions by local farmers.

As part of the reporting procedure all data must be submitted in MS Excel format, accompanied with any necessary descriptions and full metadata. Reports will be submitted in MS Word and PDF format.

SCHEDULE

The schedule for this plan is summarized below.

Review of historical climate data, Baseline[1] Climate Data collection, new climate station siting and installation, farm operator interview preparations (Tasks 1, 2, 3, 4, 5)	• January 2016 – December 2017
Data Collection from all Climate Stations, Farm operator and Producer group interviews, Data analysis for Five Years Prior to Reservoir Filling (Tasks 1, 4, 5, and 6)	• Five Years Prior to Reservoir Filling (December 2017 - December 2022) • Five Year Post Reservoir Filling (January 2023 - January 2028)
Annual Reporting and Final Reporting (Tasks 7 and 8)	• July 2016 – July 2028

From January 2016 to December 2017 historical climate data and baseline climate data will be reviewed. The existing climate station network will be upgraded and expanded as described in Tasks 2 and 3. The complete climate station network, including new stations, will be operational by December 2017. The full monitoring plan implementation will be undertaken over 10 years, commencing 5 years prior to reservoir filling and ending 5 years post reservoir filling. Results will be analyzed and documented within annual reports. Calculation of crop drying indices and consideration of plan specific management questions and hypothesis will begin to be reported as of the annual report following one year of full climate station data collection.

This work is not conditional on the results of any other monitoring plans and should start regardless of the outcomes of other studies. The climate data collected as part of this study will also be used in Monitoring to Estimate Irrigation Water Requirements (Monitoring Plan D – Appendix D).

REFERENCES

British Columbia Ministry of Environment. 1983. Climatic Capability for Agriculture, Mapsheets 94A/SW and 94A/SE. Victoria, B.C

BC Grain Producers Association (2015) “Peace- Agriculture Weather Monitoring and Decision Support Tools” Available at: http://www.bcgrain.com/Current_Projects.html. Accessed: December 2015.

[1] Baseline data refers to the continued collection of data from existing climate stations and monitoring sites. As new stations and sites are added, and additional parameters are included on existing stations, this data will be incorporated into reporting as it becomes available.

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013.

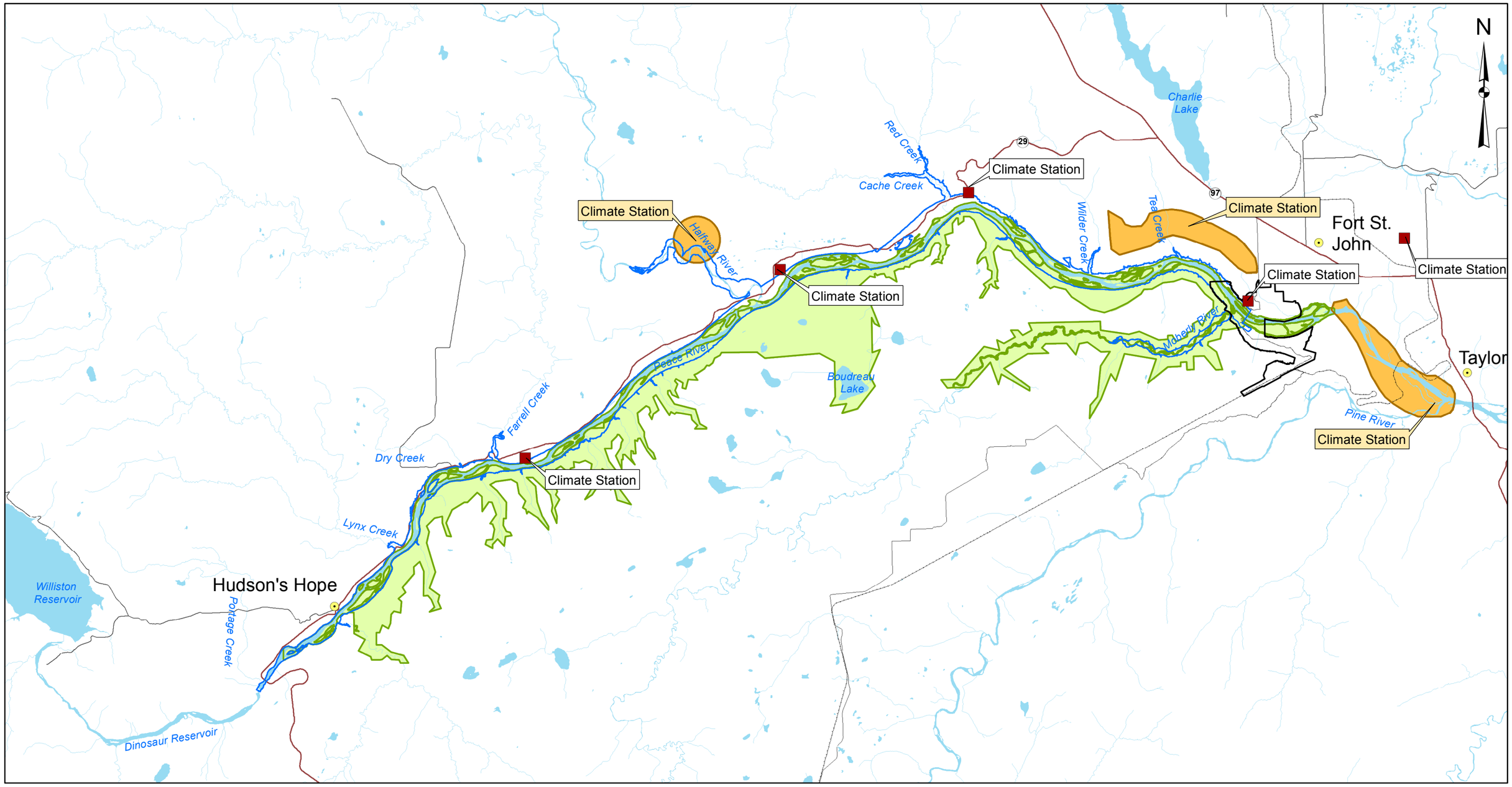
BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013.

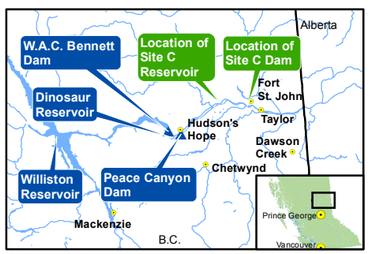
BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Section 20 Agriculture. Subsection 20.3 Mitigation Measures (20.3.7.2.2)

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Appendix D Agricultural Assessment Supporting Documentation. Appendix A. Climatic Moisture Deficit MD Calculations

Dyer, J.A. and D.M. Brown (1977). A climatic simulator for field-drying hay. Agricultural Meteorology, 18:37-48

Schnorbus, M., K. Bennett, A. Werner and A. Berland. 2011. Hydrological Impacts of Climate Change in the Peace, Campbell and Columbia Watersheds, British Columbia, Canada. Pacific Climate Impacts Consortium, University of Victoria. Victoria, B.C.





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.

Legend

- BC Hydro Climate Station
- Area to be Considered For Climate Station
- Proposed Reservoir
- Dam Site Area
- Proposed Peace River Boudreau Lake Protected Area
- CITY_2MILL
- Road
- Highway
- Railway

1:250,000

0 5 km

BC Hydro

Figure 1
Climate Stations

Date	December 17, 2015	DWG NO	1016-C14-07078	R 0

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

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APPENDIX C: Monitoring Potential Groundwater Effects

AGRICULTURE - GROUNDWATER EFFECTS MONITORING PLAN

SUMMARY

Description	Changes in groundwater elevations which may affect crop production in areas adjacent to the reservoir will be monitored in accordance with this plan.
Parameters	Selected locations adjacent to the reservoir. See Figure 1: Groundwater Monitoring Area Maps #1 through 5.
Project components	Groundwater levels, soil moisture, and climate data, information obtained from interviews and consultation.
Monitoring Category	Status and Trend Monitoring
Schedule	January 2016 to July 2028.

RATIONALE

BACKGROUND

The Site C Clean Energy Environmental Impact Statement (BC Hydro. 2013)("EIS") identifies changes to local hydrology and groundwater as a key indicator for agriculture (EIS Section 20, Table 20.3). EIS Section 20.3.2.2 (page 20-34, lines 7 to 19) states:

"The reservoir would result in rises in the groundwater elevation in areas near the reservoir and may affect agricultural land where the water table is anticipated to rise within 1 m of surface. Yields or the range of suitable crops may be affected on agricultural properties located on low terraces and banks near the proposed reservoir. However, since the majority of the cultivated lands within the LAA are located topographically above the proposed reservoir levels by greater than 1 meter, and in most cases by greater than 10 m, only limited effects related to water table rise are anticipated."

In accordance with Environmental Assessment Certificate Condition No. 31, this study is intended to determine if there are reservoir induced changes to groundwater elevations on adjacent agricultural land which results in a negative effect on crop production. Condition No. 31 states:

"The Agriculture Monitoring and Follow-up Program must include monitoring for Project-induced changes to groundwater elevations within 2 km of the reservoir (the area potentially influenced by groundwater elevation changes), and evaluate associated effects on crop productivity. Monitoring must include field surveys and farm operator interviews."

Data will be collected and evaluated to determine if crop productivity, including yield and limitations on cropping selection, in areas within 3 kms of the reservoir is potentially altered. The data to be collected will include:

- measured groundwater levels;
- observations of crop growth;
- measurements of soil moisture;
- climate data; and,
- information obtained from interviews with farm operators.

In some locations, a rise in the groundwater elevation could benefit agricultural production by increasing soil moisture levels and increasing yields, while not affecting the crop health.

QUESTION

The question to be addressed by the monitoring plan is: 'What is the effect of the reservoir induced changes to groundwater elevations on crop productivity?'

HYPOTHESIS

The hypothesis to be tested relates crop productivity to changes in groundwater elevations. The hypothesis can be stated:

> H_0: Reservoir induced changes to groundwater elevations do not adversely affect crop production.

The hypothesis will be tested by monitoring groundwater elevations near locations where groundwater effects may occur, observing crop growth, measuring soil moisture content, and by interviewing farm operators in these locations.

MITIGATION AND COMPENSATION QUESTIONS AFFECTED

If this hypothesis is rejected in site specific locations, then the potential impact on crop productivity will be discussed with directly affected property owners, and appropriate agreements for mitigation will be entered into with affected farm operators where project-related impacts on agricultural operations are not already addressed under agreements with BC Hydro.

MONITORING PLAN

APPROACH

Physical environmental data will be collected, field surveys will be conducted, and interviews of operators of farms with land at elevations less than 2 m above the full supply level of the reservoir will be conducted to evaluate the magnitude, if any, of adverse groundwater effects on crop production.

The Site C Agricultural Assessment states the reservoir would result in rises in the groundwater elevation in areas near the reservoir and may affect agricultural land where the water table is anticipated to rise within 1 m of surface. (BC Hydro, 2013, Section 20.3.2.2). Yields or the range of suitable crops may be affected on agricultural properties located on low terraces and banks near the proposed reservoir. However, since the majority of the cultivated lands within the agricultural land local assessment area are located topographically above the proposed reservoir levels by greater than 1 m, and in most cases by greater than 10 m, only limited effects related to water table rise are anticipated.

To assess any groundwater effects, areas which are less than 2 m above the reservoir full supply level have been identified and groundwater elevations in these areas will be monitored. These areas are identified in "Groundwater Monitoring Area Maps #1-5".

BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan.

TASKS

The objective of this monitoring plan is to address the management question of whether groundwater elevation changes effect crop productivity by collecting data necessary to draw inferences and to test the management hypothesis.

The plan will consist of the following steps.

1. Task 1:Project Co-ordination
2. Task 2: Baseline data review, selection of monitoring sites for field surveys, and Identification of farm operators for interviews
3. Task 3: Data collection from climate stations, and existing reservoir groundwater wells
4. Task 4: Field Surveys and Interviews with selected farm operator, and engagement with producers groups
5. Task 5: Data analysis and Annual reporting
6. Task 6: Final Reporting

The individual tasks are described in detail below.

Task 1. Project coordination. Project coordination will involve the general administrative and technical oversight of this monitoring plan. This task will include: 1) budget management, 2) team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer and report submission.

Task 2. Baseline data review, Selection of monitoring sites for field survey, and Identification of farm operators for interviews. Baseline data will be reviewed, including rainfall data from existing climate stations. *Groundwater Monitoring Area Maps #1 through 5* (included at end of this plan), identify potential groundwater monitoring areas based on an elevation of 464m, approximately 2.4 meters above reservoir full supply level of 461.6m (BC Hydro. 2013). The final selection of monitoring sites for field surveys will include ground truthing site visits.

Farm operators working in the vicinity of monitoring areas, as identified in the *Groundwater Area Maps #1 through 5* will be identified, and requests will be made for their participation in annual interviews. A questionnaire will be developed to gather the following information:

- Drainage: perceptions on growing conditions and variability
- Crop and soil type
- Crop productivity yield quantities and changes.

Task 3. Data collection from climate stations and existing groundwater wells. Data from climate stations, primarily rainfall data, and data from nearby BC Hydro groundwater monitoring wells (piezometers) will be collected throughout the monitoring period. Data will be downloaded regularly by BC Hydro environmental monitors.

Field Surveys and Interviews with selected farm operator, and engagement with producers groups

Task 4: Field Surveys, Interviews with selected farm operator, and engagement with producers groups. The field survey monitoring locations (at pre-determined monitoring sites identified in Task 2) will be visited an average of two times per year to observe the following:

- Crop growth will be observed and documented with digital pictures.
- Crop growth comparisons at locations less than 2 m above the FSL and at adjacent locations at elevations greater than 3 m above the full supply level of the reservoir.
- Periodically collect soil samples for analysis of soil moisture content (at 1 meter and 50cm depths).

Interviews will be conducted with operators of farms in the area of field surveys to obtain information on their experiences farming the potentially affected areas, and to compare with data collected from climate stations and field surveys. Farm operator interviews will be undertaken once per year. BC Hydro will seek to collaborate with associations, producer groups and government agencies that may have data or local knowledge related to this monitoring plan.

Task 5. Data Analysis and Annual Reporting. In years one and two of the plan, annual reports will provide a summary of activities including baseline data review, selection of monitoring sites for field surveys, preparation for farm operator interviews. During the 10 years of full plan implementation (5 years pre and post-reservoir filling) complete summaries of the collected data and analyses, and of the information collected during interviews with farm operators, will be presented in annual reports. During the 10 year implementation phase the annual reporting will include:

- A summary of the project;
- Maps showing field survey monitoring locations;
- Descriptions of steps taken for QA/QC and to address sources of error;
- Summaries of collected climate data and reference to ground water well data as appropriate;
- Summaries of farm operator interviews and producer group engagement;
- An assessment of the findings as they relate to the management question; and
- Any recommended changes to the monitoring plan.

Task 6. Final Reporting. At the conclusion of the monitoring periods (5 years after reservoir filling) a final report will be prepared to evaluating the effect of groundwater elevation changes to crop production. Determination of the site specific effects and discussion on need for any additional work to assess the issue will be made. These results, along with summaries of the annual reports, will be included in a final report which will be submitted to stakeholders identified in EAC Condition 31.

INTERPRETATION OF MONITORING PLAN RESULTS

As described above, all data collected as part of this plan will be analyzed and interpreted in relation to the management question, 'What is the effect of the reservoir induced changes to groundwater elevations on crop production?.'

Evaluation of effects due to groundwater elevation change will be based on measured groundwater elevations, observed growing conditions in areas at elevations less than 2 m above the full supply level compared to growing conditions in adjacent areas at elevations greater than 3 m above the full supply, and measures soil moisture content.

As part of the reporting procedure all data will be submitted in MS Excel format, accompanied with any necessary descriptions. Field survey monitoring observations and farm operator interviews summaries will identify whether or not there has been an adverse effect on site specific crop production. Annual reports will be prepared as per the schedule identified above. Reports will be submitted in MS Word and PDF format.

SCHEDULE

The schedule for this plan is summarized below.

Historical data collection, selection of monitoring sites for field surveys, and preparation for farm operator interviews (Includes Tasks 1,2,3)	• January 2016 – December 2017
Data collection, field surveys, interviews, data analysis (Includes Tasks 1, 3, 4)	• Five Years Prior to Reservoir Filling December 2017- December 2022 • Five Year Post Reservoir Filling January 2023

	to January 2028
Annual and Final Reporting (Includes Tasks 5 and 6)	• July 2016 – July 2028

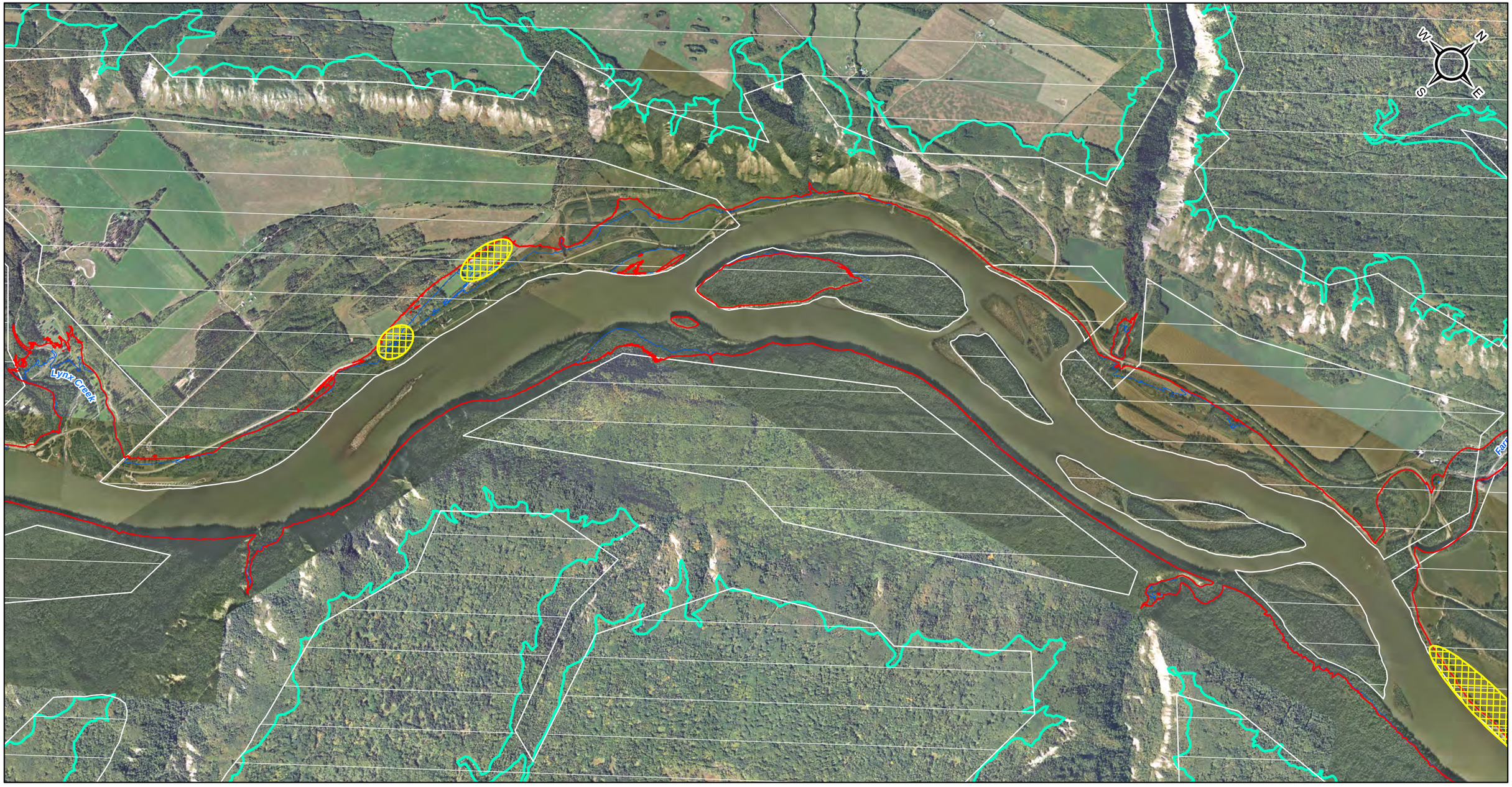
From January 2016 to December 2017 baseline data will be reviewed, including elevation mapping and rainfall data from existing climate stations. Selection of monitoring sites for field surveys will include ground truthing of Groundwater monitoring area Maps 1-5. Farm operators in these areas and producer groups will be identified and invited to participate in annual interviews, determination of field survey locations, and consultation. The full monitoring plan implementation, including field work, interviews, and data interpretation in consideration of the management question and hypothesis will be completed over 10 years, commencing 5 years prior to reservoir filling and ending 5 years after reservoir filling. Results will be analyzed and reported on within annual reports.

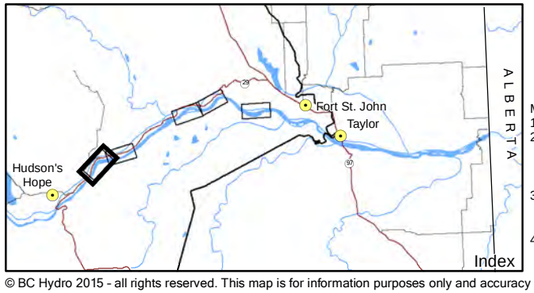
REFERENCES

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013.

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Section 20 Agriculture. Subsection 20.3 Mitigation Measures.

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013. Volume 3, Appendix D Agricultural Assessment Supporting Documentation.





Map Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Proposed Reservoir Area (461.8 m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August 2006.
3. Data Source: Orthophotos created from 1:5,000 photos taken in Aug. 2011 and 1;40,000 photos taken Sept. 10th 2007.
4. Peace River Valley Definition, Peace River Definition and Dam Site Area provided by BC Hydro.

Legend

- Groundwater Monitoring Area
- Peace River and Tributary Valleys Definition
- Proposed Reservoir FSL 461.8m
- Dam Site Area
- Agricultural Land Reserve
- 464m Contour Elevation

1:25000

0 800 m

SITE C CLEAN ENERGY PROJECT

BC hydro Golder Associates

Figure 1
Groundwater monitoring areas
Map 1 of 5

Date	October 19, 2015	DWG NO	1016-C14-B5031-1-1	R 1

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

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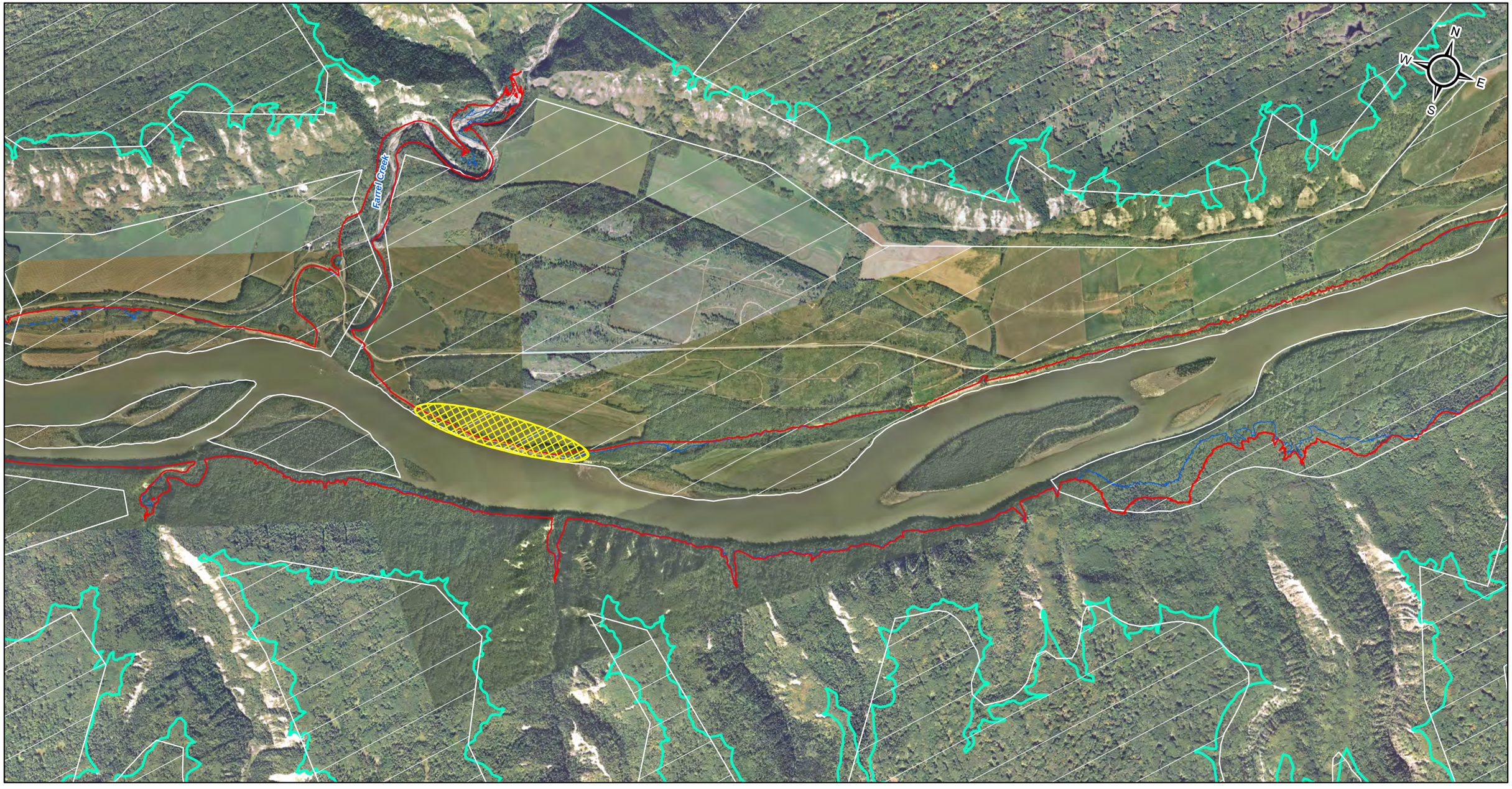

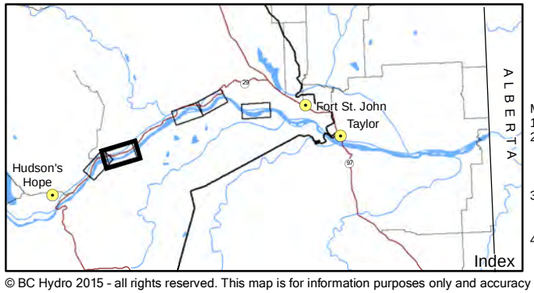

Map Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Proposed Reservoir Area (461.8 m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August 2006.
3. Data Source: Orthophotos created from 1:5,000 photos taken in Aug. 2011 and 1;40,000 photos taken Sept. 10th 2007.
4. Peace River Valley Definition, Peace River Definition and Dam Site Area provided by BC Hydro.

Legend

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- Dam Site Area
- Agricultural Land Reserve
- 464m Contour Elevation

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SITE C CLEAN ENERGY PROJECT

BC hydro Golder Associates

Figure 1
Groundwater monitoring areas
Map 2 of 5

Date	October 19, 2015	DWG NO	1016-C14-B5031-1-2	R 1

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

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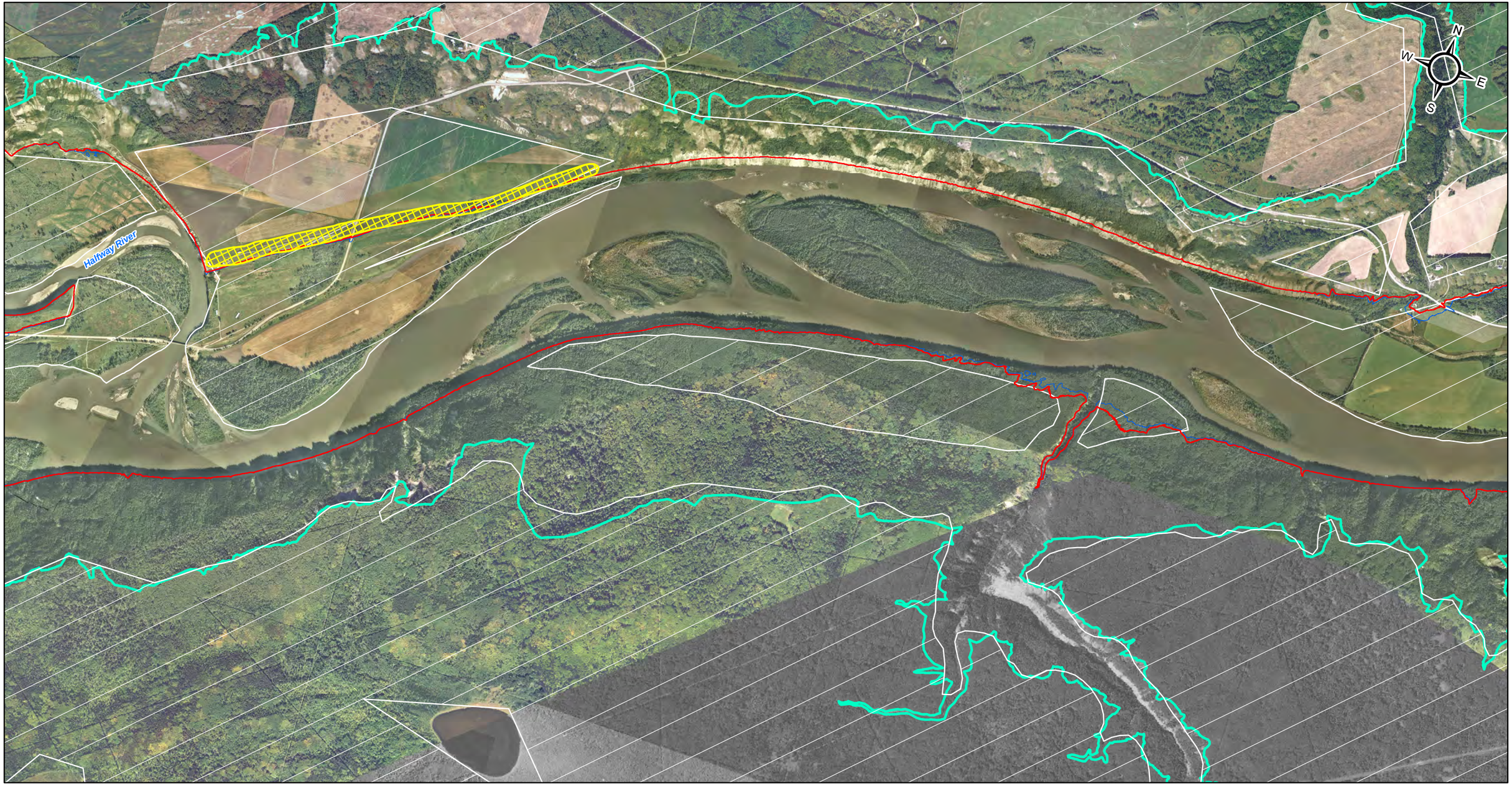

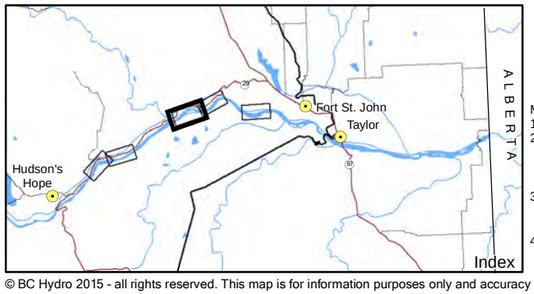

Map Notes:
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2. Proposed Reservoir Area (461.8 m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August 2006.
3. Data Source: Orthophotos created from 1:5,000 photos taken in Aug. 2011 and 1;40,000 photos taken Sept. 10th 2007.
4. Peace River Valley Definition, Peace River Definition and Dam Site Area provided by BC Hydro.

Legend

- Groundwater Monitoring Area
- Peace River and Tributary Valleys Definition
- Proposed Reservoir FSL 461.8m
- Dam Site Area
- Agricultural Land Reserve
- 464m Contour Elevation

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0 800 m

SITE C CLEAN ENERGY PROJECT

BC hydro · Golder Associates

Figure 1
Groundwater monitoring areas
Map 3 of 5

Date	October 19, 2015	DWG NO	1016-C14-B5031-1-3	R 1

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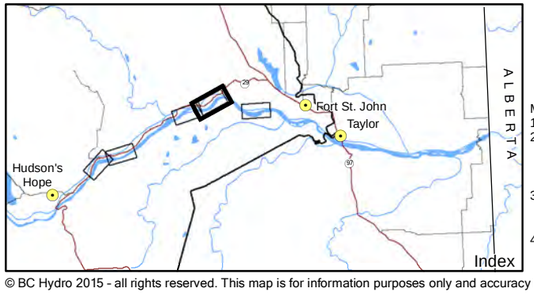

Map Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Proposed Reservoir Area (461.8 m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August 2006.
3. Data Source: Orthophotos created from 1:5,000 photos taken in Aug. 2011 and 1;40,000 photos taken Sept. 10th 2007.
4. Peace River Valley Definition, Peace River Definition and Dam Site Area provided by BC Hydro.

Legend

- Groundwater Monitoring Area
- Peace River and Tributary Valleys Definition
- Proposed Reservoir FSL 461.8m
- Dam Site Area
- Agricultural Land Reserve
- 464m Contour Elevation

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0 800 m

SITE C CLEAN ENERGY PROJECT

BC hydro Golder Associates

Figure 1
Groundwater monitoring areas
Map 4 of 5

Date	October 19, 2015	DWG NO	1016-C14-B5031-1-4	R 1

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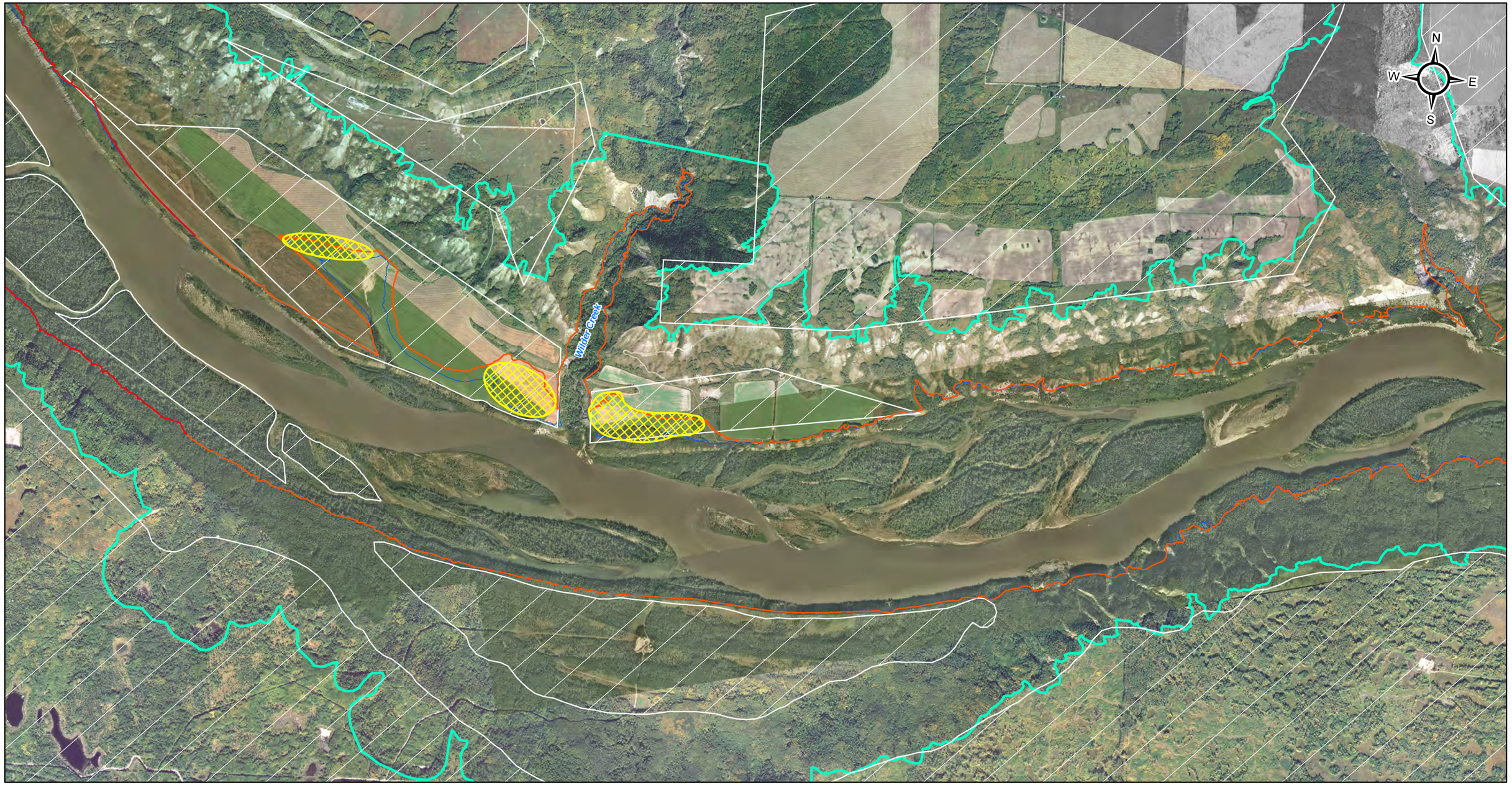

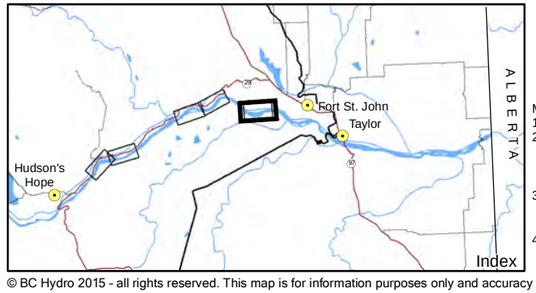

Map Notes:
1. Datum/Projection: NAD83/UTM Zone 10N
2. Proposed Reservoir Area (461.8 m maximum normal elevation) from Digital Elevation Models (DEM) generated from LiDAR data acquired July/August 2006.
3. Data Source: Orthophotos created from 1:5,000 photos taken in Aug. 2011 and 1;40,000 photos taken Sept. 10th 2007.
4. Peace River Valley Definition, Peace River Definition and Dam Site Area provided by BC Hydro.

Legend

- Groundwater Monitoring Area
- Peace River and Tributary Valleys Definition
- Proposed Reservoir FSL 461.8m
- Dam Site Area
- Agricultural Land Reserve
- 464m Contour Elevation

1:25000

0 800 m

SITE C CLEAN ENERGY PROJECT

BC hydro · Golder Associates

Figure 1
Groundwater monitoring areas
Map 5 of 5

Date	October 19, 2015	DWG NO	1016-C14-B5031-1-5	R 1

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

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APPENDIX D: Monitoring to Estimate Irrigation Water Requirements

AGRICULTURE – MONITORING TO ESTIMATE IRRIGATION WATER REQUIREMENTS

SUMMARY

Description	This study will monitor climate data and estimate irrigation water requirements.
Parameters	Selected locations within 3 km of the reservoir
Project components	Climate station data to inform irrigation requirement
Monitoring Category	Status and Trend Monitoring
Closely related studies	Monitoring Plan B. Monitoring of Reservoir Induced Effects on Crop Drying.
Timeline	January 2016 to July 2028.

RATIONALE

BACKGROUND

The Site C Clean Energy Environmental Impact Statement (BC Hydro. 2013)("EIS") Section 20.3.4.1.2 identifies irrigation improvements as a potential mitigation measure for the permanent loss of agricultural land. Lines 25 to 27, page 20-42, of this section states "Irrigation research, demonstration projects, and funding assistance for irrigation water supply infrastructure will be considered within the proposed agricultural compensation fund."

Environmental Assessment Condition No. 31 states "the Agriculture Monitoring and Follow-up Program must include monitoring for climatic factors to estimate moisture deficits and to estimate irrigation water requirements in the vicinity of the reservoir to provide information for potential future irrigation projects. Data collection will be undertaken before reservoir filling, and in the 5 years after reservoir filling, and data will be reviewed as required for proposed irrigation projects. "

In accordance with Condition No. 31, this study will monitor climate data and estimate irrigation water requirements.

QUESTION

The key management question to address is: "What amount of water may be required for irrigation?"

For this study there is no hypothesis to be tested.

KEY MITIGATION AND COMPENSATION QUESTIONS AFFECTED

The study is to provide estimates of irrigation water requirements to support potential future projects related to irrigation. Results from the Monitoring to Estimate Irrigation Water Requirements Plan may be used to support future decisions regarding irrigation improvements.

MONITORING PROGRAM PROPOSAL

APPROACH

The monitoring plan approach will include collection of climate station data, and calculation of estimates of peak and annual irrigation water requirements using the collected climate data and information on soil characteristics collected during the land capability for agriculture portion of the environmental assessment (described in EIS Section 20.2.2).

TASKS

The objective of this monitoring program is to collect and analyse climate data to generate estimates of irrigation water requirements. The plan will rely on climate station installation, maintenance, and data collection tasks carried out in the Monitoring of Reservoir Induced Effects on Crop Drying Plan. (Appendix B).

This plan will include the following steps:

1. Task 1: Project Co-ordination
2. Task 2: Plan Coordination with Monitoring Plan B, Baseline data collection and review
3. Task 3: Climate Station Data collection
4. Task 4: Data Analysis and Annual Reporting
5. Task 5: Final Reporting

The individual tasks are described below.

Task 1. Project Co-ordination. Project coordination will involve the general administrative and technical oversight of this monitoring program component. This task will include: 1) budget management, 2) study team management, 3) logistic coordination, 4) technical oversight of field and analysis components, and 5) facilitation of data transfer and report submission.

***Task 2. Coordination with Monitoring Plan B, Baseline Data Collection and Review*.** Working with Monitoring of Reservoir Induced Effects on Crop Drying (See Appendix B) to ensure all parameters required for this plan, are included in climate station siting and network upgrades. Climate station parameters to be included to meet the data requirements for this plan will include:

- air temperature
- humidity

- precipitation
- solar radiation
- wind speed
- wind direction
- barometric pressure
- net radiation
- soil temperature
- soil heat flux
- soil water content

Monitoring Plan B (Monitoring of Reservoir Induced Effects on Crop Drying, Appendix B) will manage climate station siting, installation, maintenance and data collection from climate stations. Baseline data collection from existing climate stations includes the continued collection of data from existing climate stations. As new stations are added, and additional parameters are included on existing stations, this data will be included in reporting as it becomes available. Historical climate station data and previous consultation input received on irrigation will also be reviewed.

Task 3. Climate Station Data collection. In coordination with Monitoring Plan B *"Monitoring of Reservoir Induced Effects on Crop Drying*" and as described in the terms of reference for the Agriculture – Monitoring of Reservoir Induced Effects on Crop Drying (Appendix B), a network of climate stations to monitor the influence of the reservoir on crop drying and irrigation demand will be in place to monitor the climatology in agricultural areas adjacent to, intermediate, and away from the effects of reservoir boundary conditions predicted by the microclimatic model results. (BC Hydro. 2013). Data from these stations relevant to estimating irrigation water requirements will be collected and summarized annually.

Task 4. Data analysis and annual reporting. Historical climate data collected by the existing climate stations will provide baseline data, and will be reviewed in 2017. In 2017, historical climate data collected by the existing climate stations and previous consultation will be analysed to provide baseline for the analysis and reporting. In the 5 years pre and post-reservoir filling, complete summaries of the collected data from the new and existing BC Hydro climate stations will be analyzed annually to estimate irrigation water requirements. Summaries of the collected data and analyses will be presented in annual reports.

During the 10 year implementation phase, the annual reporting will include:

- A summary of the project;
- Maps showing climate station locations;
- Summaries of collected data in tabular and graphical format;
- Description of statistical analyses and results;
- An assessment of the findings as they relate to irrigation water requirements including estimation of peak and annual irrigation water requirements ; and
- Any recommended changes to the monitoring program.

Task 5. Final Reporting. Five years after reservoir filling, at the conclusion of the monitoring period, estimates of peak and annual irrigation requirements and of the variability in these requirements, and a determination of the need for any additional work to assess the issue will be made. These results, along with summaries of the annual reports, will be included in a final report.

INTERPRETATION OF MONITORING PROGRAM RESULTS

Irrigation water requirements will be estimated at each climate station based on precipitation data and evapotranspiration estimates calculated by the Penman Monteith equation, which is the standard method recommended by the UN Food and Agriculture Organization (FAO, 1998). The estimates will include peak and annual irrigation water requirements, and the estimated temporal and spatial variability in requirements. The estimates will provide information to support potential irrigation plans.

As part of the reporting procedure all data must be submitted in MS Excel format, accompanied with any necessary descriptions and full metadata. Reports will be submitted in MS Word and PDF format.

SCHEDULE

The schedule for this plan is summarized below.

Coordination with Monitoring Plan B, Baseline Data Collection, Review of historical climate station data and previous consultation input received on irrigation. (Tasks 1 and 2)	• January 2016 – December 2017
Climate station data collection, and data analysis (Tasks 1, 2, 3, 4)	• Five Years Prior to Reservoir Filling December 2017- December 2022 • Five Year Post Reservoir Filling January 2023 - January 2028
Annual and Final Reporting (Task 4, 5)	• July 2016 – January 2028

From January 2016 to December 2017 baseline climate data will be reviewed. The existing climate station network will be upgraded and expanded between January 2016 to December 2017, as described in Monitoring of Reservoir Induced Effects on Crop Drying (Appendix B, Tasks 2 and 3). The complete climate station network, including new stations, will be operational by December 2017.

This plan will utilize climate data collected as part of the Monitoring of Reservoir Induced Effects on Crop Drying plan (Appendix B). During the 5 years prior to reservoir filling and 5 years post reservoir filling reporting of climate station data and calculation of irrigation water requirements will be included in annual reports.

REFERENCES

BC Grain Producers Association (2015) "Peace – Evaluation of Irrigation Potential in the BC Peace Region" Available at: http://www.bcgrain.com/Current_Projects.html. Accessed: December 2015.

FAO. (1998). Crop Evapotranspiration – Guidelines for Computing Crop Water Requirements. Rome: Food and Agriculture Organization of the United Nations – Paper 56.

BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Dated January 25, 2013; Amended August 2, 2013.

APPENDIX E: Environmental Assessment Background

Environmental Assessment Background

1. The Site C Clean Energy Project

The Site C Clean Energy Project (the Project) will be the third dam and generating station on the Peace River in northeast B.C. The Project will provide 1,100 megawatts of capacity and about 5,100 gigawatt hours of energy each year to the province's integrated electricity system. The Project will be a source of clean, reliable and cost-effective electricity for BC Hydro's customers for more than 100 years.

The components of the Project are:

- an earthfill dam, approximately 1,050 metres long and 60 metres high above the riverbed;
- an 83 kilometre long reservoir that will be, on average, two to three times the width of the current river;
- a generating station with six 183 MW generating units;
- two new 500 kilovolt AC transmission lines that will connect the Project facilities to the Peace Canyon Substation, along an existing right-of-way;
- realignment of six segments of Highway 29 over a total distance of approximately 30 kilometers; and
- construction of a berm at Hudson's Hope.

The Project will also include the construction of temporary access roads, a temporary bridge across the Peace River, and worker accommodation at the dam site.

2. Project Benefits

The Project will provide important benefits to British Columbia and Canada. It will serve the public interest by delivering long term, reliable electricity to meet growing demand; contribute to employment, economic development, ratepayer, taxpayer and community benefits; meet the need for electricity with lower GHG impact than other resource options; contribute to sustainability by optimizing the use of existing hydroelectric facilities, delivering approximately 35 per cent of the energy produced at the W.A.C. Bennett Dam, with only five per cent of the reservoir area; and include an honourable process of engagement with First Nations and the potential for accommodation of their interests.

3. Environmental Assessment Process

The environmental assessment of the Project has been carried out in accordance with the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), the *BC Environmental Assessment Act* (BCEAA), and the Federal-Provincial *Agreement to Conduct a Cooperative Environmental Assessment, Including the Establishment of a Joint Review Panel of the Site C Clean Energy Project*. The assessment considered the environmental, economic, social, heritage and health effects and benefits of the Project, and included the engagement of Aboriginal groups, the public, all levels of government, and other stakeholders in the assessment process.

Detailed findings of the environmental assessment are documented in the Site C Clean Energy Project Environmental Impact Statement (EIS), which was completed in accordance with the Environmental Impact Statement Guidelines (EIS Guidelines) issued by the Minister of Environment of Canada and the Executive Director of the Environmental Assessment Office of British Columbia. The EIS was submitted to regulatory agencies in January 2013, and amended in August 2013 following a 60 day public comment period on the assessment, including open house sessions in Fort St. John, Hudson's Hope, Dawson Creek, Chetwynd, town of Peace River (Alberta) and Prince George.

In August 2013, an independent Joint Review Panel (JRP) commenced its evaluation of the EIS, and in December 2013 and January 2014 undertook five weeks of public hearings on the Project in 11 communities in the Peace region, including six Aboriginal communities. In May 2014, the JRP provided the provincial and federal governments with a report summarizing the Panel's rationale, conclusions and recommendations relating to the environmental assessment of the Project. On completion of the JRP stage of the environmental assessment, the CEA Agency and BCEAO consulted with Aboriginal groups on the JRP report, and finalized key documents of the environmental assessment for inclusion in a Referral Package for the Provincial Ministers of Environment and Forests, Lands and Natural Resource Operations.

Construction of the Project is also subject to regulatory permits and authorizations, and other approvals. In addition, the Crown has a duty to consult and, where appropriate, accommodate Aboriginal groups.

4. Environmental Assessment Findings

The environmental assessment of the Project focused on 22 valued components (VCs), or aspects of the biophysical and human setting that are considered important by Aboriginal groups, the public, the scientific community, and government agencies. In the EIS, valued components were categorized under five pillars: environmental, economic, social, heritage and health. For each VC, the assessment of the potential effects of the Project components and activities during construction and operations was based on a comparison of the biophysical and human environments between the predicted future conditions with the Project, and the predicted future conditions without the Project.

Potential adverse effects on each VC are described in the EIS along with technically and economically feasible mitigation measures, their potential effectiveness, as well as specific follow-up and related commitments for implementation. If a residual effect was found on a VC, the effect was evaluated for significance. Residual effects were categorized using criteria related to direction, magnitude, geographic extent, context, level of confidence and probability, in accordance with the EIS Guidelines.

The assessment found that the effects of the Project will largely be mitigated through careful, comprehensive mitigation programs and ongoing monitoring during construction and operations. The EIS indicates that the Project is unlikely to result in a significant adverse effect for most of the valued components. However, a determination of a significant effect of the Project was found on four VCs: Fish and Fish Habitat, Wildlife Resources, Vegetation and Ecological Communities, and Current Use of Lands and Resources for Traditional Purposes.

5. Environmental Assessment Conclusion

On October 14, 2014, the Provincial Ministers of Environment and of Forests, Lands and Natural Resource Operation decided that the Project is in the public interest and that the benefits provided by the Project outweigh the risks of significant adverse environmental, social

and heritage effects (http://www.newsroom.gov.bc.ca/2014/10/site-c-project-granted-environmental-assessment-approval.html). The Ministers have issued an Environmental Assessment Certificate setting conditions under which the Project can proceed.

Further, on November 25, 2014, The Minister of Environment of Canada issued a Decision Statement confirming that, while the Project has the potential to result in some significant adverse effects, the Federal Cabinet has concluded that those effects are justified in the circumstances. The Decision Statement sets out the conditions under which the Project can proceed.

6. Consultation

BC Hydro began consultation on the Project in late 2007, before any decision to advance the Project to an environmental assessment. BC Hydro's consultation with the public, stakeholders, regional and local governments, regulatory agencies, and Aboriginal groups is described in EIS Section 9, Information Distribution and Consultation.

Additional information on the consultation process and a summary of issues and concerns raised during consultation are provided in:

- EIS, Volume 1, Appendix G, Public Information Distribution and Consulting Supporting Documentation
- EIS, Volume 1, Appendix H, Aboriginal Information Distribution and Consultation Supporting Documentation
- EIS, Volume 1, Appendix I, Government Agency Information Distribution and Consultation Supporting Documentation
- EIS, Volume 5, Appendix A01 to A29, Parts 2 and 2A, Aboriginal Consultation Summaries
- Technical Memo: Aboriginal Consultation

BC Hydro engaged Provincial Ministry of Agriculture staff and the Peace River Regional District Agriculture Advisory Committee during the development of the Environmental Impact Statement and early in the design of the monitoring program. Ministry of Agriculture staff provided specific information on the BC Ministry of Agriculture's Wildlife Damage Compensation Program.

In accordance with EAC Condition 31, a draft version of this AMAFP was submitted to the Ministry of Agriculture, Peace River Regional District and the District of Hudson's Hope for review and comment on October 23, 2015 (within 90 days of commencement of construction).

Interviews with potentially affected farm operators and or owners were carried out in 2011 and 2012 (BC Hydro. 2013d).

These interviews were conducted in order collect information related to current and future agricultural activities and information required to define and evaluate on-farm changes that may result from the Project. There were 34 farm operations identified where a portion of the operation would be within the Project activity zone. The owners or operators of 22 of those farm operations participated in interviews.

Information obtained during these interviews, alongside other sources of information (e.g. direct observations, air photo observations) about farm operations in the project activity zone, were presented in summary form within the assessment. Interview documentation, including responses to questions and information contained on maps relevant to their agricultural holdings were retained by BC Hydro and shared with interviewees. (BC Hydro. 2013c.)

Information sought during the interviews with owners and operators included the following:

- Current and future land use
- Soil and crop management practices, including crop rotation practices
- Crop yields and farm gate prices
- Livestock use, movements, and production
- Farm infrastructure and improvements and other investments that have been made or might be considered
- Historical and potential trends in agricultural land use
- Motivating factors in land use decision making
- Non-farm infrastructure used by farm operations
- Projected changes to land use if the Project proceeds
- Marketing and distribution channels used, including access and transportation needs
- Agricultural inputs acquisition channels
- Short- and long-term concerns related to potential effects of the Project on agricultural operations
- Avoidance and mitigation options
- Regional compensation and enhancement opportunities.

During the construction of the Project, BC Hydro will consult with affected agricultural land owners and tenure holders, and Ministry of Agriculture at least annually. Input received in consultation with those parties will be taken into account in considering potential revisions to this Plan in accordance with Section 12.0 of this Plan.

7. Regulatory Context

In constructing and operating the Project, BC Hydro and its contractors must comply with laws, regulations, and standards of general applicability, as well as Project-specific conditions of approvals, permits, other authorizations, guidelines and protocols that are relevant to the design and implementation of mitigation programs. The following subsections explain how this AMAFP considers and integrates regulatory requirements that pertain to agriculture as required for the Project.

The Federal Decision Statement does not include any requirements with respect to the potential for the Project to impact agricultural land owners and tenure holders.

As described in Section 20.1.1 of the EIS, some of the land that would be temporarily or permanently occupied by the Project was within the province's Agricultural Land Reserve (ALR). The ALR is managed in B.C. under the *Agricultural Land Commission Act* (S.B.C., 2002). As per Order in Council #148, Order Respecting Lands in the Agricultural Reserve, on April 8, 2015 certain of these lands were temporarily excluded from the ALR until December 31, 2024, and other lands were permanently excluded.

Agricultural Crown land tenures are administered under the *Range Act* (S.B.C., 2004) and under the *Land Act* (R.S.B.C., 1996). Crown land management in the Project activity zone is also guided by the Dawson Creek and Fort St. John Land and Resource Management plans.

APPENDIX F: Agriculture Effects Assessment

Agriculture Effects Assessment

1. Introduction

The potential effect of the Project on agriculture was assessed in Section 20 of the EIS, as amended (July 2013). The assessment considered the potential for the Project to effect four key aspects of agriculture in the local assessment area including:

- Temporary and permanent loss of agricultural land;
- Changes in individual farm operations, including potential changes to local microclimate that could affect agriculture;
- Changes in agricultural economic activity; and,
- Changes in local and regional food production and consumption.

2. Assessment Area

The Local Assessment Area for changes to the agricultural land base and changes to individual farm operations includes the Project activity zone[1] plus the remainder of any farm operations that overlap with the Project activity zone. The Local Assessment Area for changes to agricultural economic activity and changes to food production and consumption includes the entire Peace Agricultural Region (Peace River Regional District and the Northern Rockies Regional Municipality). The Regional Assessment Area includes the entire Peace Agricultural Region.

3. Scope of Effects Assessment

The effect of the Project on the valued component of agriculture is assessed considering the interactions between the Project and the four key aspects.

Loss of agricultural land considers the following key indicators:

- Land capability ratings (soil and climatic capability)
- Crop suitability
- Agricultural land use and Crown land tenures
- Agricultural utility (reflects relative likelihood of cultivation)

Effects on individual farm operations consider the following key indicators:

- Direct loss of land
- Changes to access routes
- Loss of farm infrastructure
- Soil disturbance and compaction
- Changes to livestock movement patterns
- Changes to irrigation and livestock watering facilities
- Changes to local hydrology and groundwater
- Changes to drainage patterns
- Introduction and proliferation of invasive plant species
- Increased biosecurity risks

[1] The Project Activity Zone is the area within which the project components and activities will be located or will occur, but this does not include existing transportation infrastructure that will be used without modification to transport materials or personnel required for the Project. (BC Hydro.2013c)

- Farm worker safety
- Reservoir induced changes to microclimate on adjacent agricultural operations

Change to the agricultural economy considers the following key indicators:

- Agricultural costs and revenues at the individual farm level
- Primary agricultural economic activity
- Opportunities for potential new agricultural economic activity
- Secondary agricultural economic activity

Changes to regional food production and consumption consider the following key indicators: regional food production and food consumption (BC Hydro 2013c).

4. Baseline Conditions

Baseline conditions for each of the key indicators are described using information collected from:

- Literature reviews including local, provincial and federal government datasets
- Field surveys
- Orthophotographs and spatial analysis
- Interviews with land owners and operators, relevant agricultural associations, representatives of agriculturally related industries and representatives of government agencies

The baseline conditions described below were reported in the EIS (BC Hydro 2013c). It is recognized that baseline conditions are dynamic and change from time to time.

4.1. Agricultural land capability ratings

The updated land capability for agriculture mapping is shown in EIS Volume 3, Section 20, Figure 20.2, Maps 1 through 25. Table 2.1 shows areas by capability class for the Peace River valley in B.C., both upstream of Site C to the Peace Canyon dam and downstream of Site C to the Alberta border, the Peace River Agricultural Region, and the province. Agricultural land capability statistics for the region and the province were obtained from B.C. Environment and Land Use Committee Secretariat (1976).

Table 4.1: Land Areas by Unimproved Agricultural Capability Class (ha)

Geographic Area	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6& 7	Total
Peace River valley in B.C. – upstream of the Site C dam site[a]	0	6,419	3,765	1,019	401	18,280	29,884
Peace River valley in B.C. – downstream of Site C to Alberta border	926	3,132	2,385	930	1,079	16,751	25,203
Peace River valley in B.C. – Total	926	9,551	6,150	1,949	1,480	35,031	55,087
Peace River Agricultural Region	3,833	121,013	365,043	501,036	1,683,351	2,091,078	4,765,354
Province	21,057	235,480	692,041	1,701,715	6,671,820	20,674,336	29,996,449

[a] Peace River valley in B.C. – upstream of the Site C dam site includes lands both within and outside the Project activity zone

4.2. Agricultural Suitability of Lands

Crops that are considered well suited or suited for different improved land capability classes within or adjacent to the proposed reservoir area are listed in Table 2.2. This table provides examples of crops that would be well suited or suited, and provides an indication of the range of crops that can be grown in areas of different land capability classes (BC Hydro 2013c).

Table 4.2 Crop Suitability by Improved Land Capability Class

Crop Type	Class 1	Class 2	Class 3	Class 4
Grains and oilseeds	Barley, millet	Barley, millet	Barley, millet	Barley, millet
	Oats, rye, wheat	Oats, rye, wheat	Oats, rye, wheat	N/A
	Canola, flax	Canola, flax	Canola, flax	N/A
	Corn – silage	Corn – silage	N/A	N/A
Legumes and grasses	Native grazing	Native grazing	Native grazing	Native grazing
	Unimproved pasture	Unimproved pasture	Unimproved pasture	Unimproved pasture
	Hay, improved pasture	Hay, improved pasture	Hay, improved pasture	Hay, improved pasture
	Alfalfa, forage seed	Alfalfa, forage seed	Alfalfa, forage Seed	N/A
	Peas	Peas	N/A	N/A
	Beans	N/A	N/A	N/A
Annual vegetables	Cabbage, lettuce	Cabbage, lettuce	Cabbage, lettuce	Cabbage, lettuce
	Potatoes, turnips, Carrots	Potatoes, turnips, Carrots	Potatoes, turnips, carrots	N/A
	Broccoli	Broccoli	N/A	N/A
	Cantaloupe, corn, cucumber, peppers, tomatoes	N/A	N/A	N/A
Berries and fruits	Raspberries, strawberries, Saskatoon berries	Raspberries, strawberries, Saskatoon berries	Raspberries, strawberries, Saskatoon berries	N/A
	Blueberries	Blueberries	N/A	N/A
	Hardy apples	Hardy apples	N/A	N/A
	Nanking cherries	N/A	N/A	N/A
	Plums	N/A	N/A	N/A

NOTE: N/A – NOT APPLICABLE

4.3. Agricultural utility ratings

Agricultural utility was classified based on the physical capability (soil and climate) and on potential constraints to agricultural use, using the following definitions developed by the agricultural assessment team:

- High utility: Class 1 through 3 lands with a high likelihood of being used for cultivated agriculture in the future

- Moderate utility: Class 4 and 5 lands with a high likelihood of being used for cultivated agriculture in the future
- Low to nil utility: Class 6 and 7 lands, and lands with a low to nil likelihood of being used for cultivated agriculture in the future

The agricultural utility ratings assigned to areas with agricultural capability within the Project activity zone are included in EIS Volume 3, Section 20, Figure 20.4, Maps 1 through 16.

The creation of the reservoir and other Project components would result in the permanent loss of approximately 3,816 hectares of land rated as capable for agricultural crop production, comprised of 3,433 hectares of Class 1 through 3, and 383 hectares of Class 4 through 5. Of these, approximately 1,666 hectares of land is rated as high to moderate agricultural utility for cultivated agriculture, reflecting the likelihood of future agricultural use. Approximately 540 hectares of land within the Project activity zone are currently cultivated and used for canola, grain, forage, and improved pasture. There are approximately 13,200 hectares land rated as agricultural capability class 1 through 3 within the B.C. Peace River valley, and approximately 485,000 hectares of remaining class 1 through 3 land in the Peace agricultural region, that would be unaffected by the project (BC Hydro 2013c).

4.4. Agricultural land use

Agricultural land use within the Project activity zone was mapped using land use information collected during interviews with agricultural property owners and operators, from field observations, and from recent air photographs. Agricultural land use as of 2011, when the majority of the agricultural operator interviews were completed, is shown in Figure 20.5, Maps 1 through 11.

4.5. Agricultural tenure on Crown lands

A total of 19 grazing tenures including 4 leases and 15 licences were identified that would be affected by the Project. The tenure boundaries are noted in Figure 20.5, Maps 1 through 10.

4.6. Current and expected future agricultural operations and practices

Interviews were conducted in 2011 and 2012 with the owners and operators of agricultural operations located in the agricultural land local assessment area to collect information related to current and future agricultural activities. Table 4.3 describes land use by Farm Operation for 34 farm operations where a portion of the operation is within the Project activity zone Summary.

Table 4.3 Land Use by Farm Operation

Operation	Crops	Livestock
1	Forage, grain	Beef (cow/calf)[a]
2	Forage	Horses
3	Forage	Beef (cow/calf)[a]
4	Forage	No livestock
5	No cropland	Bees
6	Unknown[b]	Unknown[b]
7	Forage	Beef (cow/calf)[a]
8	Forage	Beef (cow/calf)
9	Forage	Beef (cow/calf)
10	Forage (cropland is rented out)	No livestock
11	No farming activities	No livestock
12	Canola (cropland is rented out)	No livestock
13	Forage	Small numbers of livestock
14	Unknown[b]	Unknown[b]
15	Forage (cropland is rented out) (forage)	No livestock
16	Unknown[b]	Unknown[b]
17	Unknown[b]	Unknown[b]
18	Forage, canola	Beef (cow/calf), horses
19	Forage, grain, canola	Beef (cow/calf)[a]
20	Forage	No livestock
21	Forage	No livestock
22	Forage	Beef (cow/calf)
23	Canola	No livestock
24	Forage, some land leased out for canola	Horses
25	Forage	Beef (cow/calf)[a]
26	Forage (cropland is leased out)	No livestock
27	Pasture (cropland is rented out)	No livestock
28	Unknown[b]	Unknown[b]
29	Forage (cropland is leased out)	No livestock
30	Forage	Beef (cow/calf/yearling)a
31	Forage	No livestock
32	Canola (cropland rented out)	Horses
33	Forage, grain, canola	Horses
34	Pasture	Beef (cow/calf)[a]

NOTES:

[a] Farm has horses, but does not raise horses for sale

[b] Information is not available, as operator either declined or failed to respond to interview request

The following is a breakdown of the use of land on Census farms in the B.C. Peace Agricultural Region:

- Natural land for pasture: 41.1%
- Crops: 32.5%
- Tame and seeded pasture: 12.1%
- Woodlands and wetlands: 9.8%
- All other lands: 2.6%
- Summer fallow: 1.9%

The agricultural sector of the Peace Agricultural Region is predominantly mixed farming, including cow/calf operations, other livestock and grain, forage, and seed production for own use or for sale of surplus. Cash crops such as wheat, barley, oats, canola, fescue seed, and field peas have provided opportunities to augment farm incomes.

In the Peace Agricultural Region, 77% of the farms specialize in hay (43%), beef (16%), horses (12%), or livestock combinations (6%). The Peace Agricultural Region alone represents 20% of B.C.'s hay farms and 10% of its beef farms. About 11% of Peace Agricultural Region farms are oilseed (5%), wheat (1%), and other grain farm types (5%). Other types of farms include sheep, apiculture, fruit, berries and nuts, poultry and eggs, vegetables, and potatoes, with each representing less than 1% of the total farms in the region.

While all types of livestock are raised in the Peace Agricultural Region, the area has larger concentrations of B.C.'s beef cattle and bison than other livestock. The bulk of Peace Agricultural Region agriculture is oriented to the export of harvested field crops and livestock. The agricultural support industry and infrastructure is set up for bringing inputs in and transporting harvested products to the U.S., Asia, and other provinces (e.g., Alberta).

A very small proportion of Peace Agricultural Region produce is oriented for domestic consumption, local retailers, and local farmers' markets. Several livestock operations sell livestock for local slaughter to meet domestic needs and for specialty processing of bison, sheep, and deer. According to the 2011 Agriculture Census (Statistics Canada 2012a), the Peace Agricultural Region contains the majority of the provincial area in canola (94%), dry field peas (94%), wheat (87%), forage seed (86%), oats (84%), and barley (60%) (Statistics Canada 2012a, 2012b).

4.7. Local and regional agricultural economic activity

Consolidation in the input supply sector (grains and oilseeds) of the agricultural industry has intensified over the last few decades. Most of the produce and meat food products sold in the Peace Agricultural Region are marketed by large retail chains with branches throughout B.C. and Canada, via centralized distribution centres.

In 2011 agriculture in the Peace Agricultural Region comprised 1,560 farms operated by 2,325 farm operators (Statistics Canada 2012a). Agriculture employed about 3% of the region's workforce (WorkBC No date). About 55% of the land in farms in the Peace Agricultural Region was privately owned in 2011, with a further 29% leased from governments, and 16% farmed through private rental and lease arrangements.

There is a wide variation in net returns to farming in the Peace Agricultural Region. Higher gross margins are being achieved by larger farms, and low or negative gross margins by smaller

farms. Many farm operators rely on off-farm income in addition to revenues produced from farming (Statistics Canada 2012a).

4.8. Local and regional food production and consumption estimates

Regional self-reliance in the Peace Agricultural Region may be characterized as follows:

- Surplus self-reliance (over 100%) for grains (cereals), oils and fats, sugars.
- High self-reliance for red meats.
- Moderate self-reliance for fruits and berries
- Low self-reliance for vegetables, dairy and poultry
- Nil self-reliance for fish, as fish are not harvested commercially in the Peace Agricultural Region (Statistics Canada 2012a).

5. Potential Effects of the Project

Table 5.1 below describes the assessment of potential effects of the Project on Agriculture including the following:

- Temporary and permanent loss of agricultural land
- Changes in individual farm operations, including potential changes to local microclimate that could affect agriculture
- Changes in agricultural economic activity
- Changes in local and regional food production and consumption

Table 5.1 Summary of Potential Effects and Mitigation Measures

Potential Effects	**Key Mitigation Measures**
Temporary loss of agricultural land (construction and operations)	Implement Environmental Management Plans • Soil Management, Site Restoration, and Revegetation Plan • Borrow and Quarry Sites Reclamation Plan • Vegetation and Invasive Plant Management Plan
Permanent loss of agricultural land (construction and operations)	Implement mitigation measures including: • Irrigation improvements • Drainage improvements • Relocation of suitable quality soil in selected locations • Inclusion of land in the Agricultural Land Reserve • Agricultural compensation fund
Effects on individual farm operations during construction	Acquire land required for the Project and reimburse associated financial losses Implement environmental management plans, including:

	• Soil Management, Site Restoration and Revegetation Plan • Vegetation and Invasive Plant Management Plan (including biosecurity protocols) • Traffic Management Plan • Public Safety Management Plan
Effects on individual farm operations during Project operations	Evaluate effects at a property level and enter into agreements with affected landowners to mitigate in the event of: • Crop and stored feed damage due to changes in wildlife habitat utilization • Crop drying due to changes in climatic factors • Crop production due to changes in groundwater elevation • Potential for unauthorized access to farm properties due to change in land or waterbased access • Livestock damage due to new access to the reservoir
Change to agricultural economic activity (construction and operations)	Implement an Agricultural Compensation Fund
Change to regional food production and consumption during construction and operations	No changes anticipated to regional food self-reliance

6. Mitigation Measures

This section provides all the measures that will be developed and implemented to mitigate the potential effects of the Project on agriculture as described in the EIS. Note that Measure 6: Agriculture Monitoring and Follow-up Program, is the focus of the primary document. The other measures will be developed and submitted in accordance with EAC Condition 30.

6.1. Measure 1: Develop an Agricultural Mitigation and Compensation Plan

EAC Condition 30 requires the development of an Agricultural Mitigation and Compensation Plan. BC Hydro will work with a Qualified Environmental Professional (QEP), and will consult with affected agricultural land owners and tenure holders, regional agricultural stakeholders, and the Ministry of Agriculture to develop the Agricultural Mitigation and Compensation Plan ("Plan"). BC Hydro will establish a Consultation Steering Committee comprised of staff from BC Hydro, the Ministry of Agriculture and the Ministry of Energy and Mines to develop and implement the stakeholder consultation process. After consultation is completed, BC Hydro with guidance from the Consultation Steering Committee, and a QEP will prepare a framework, draft and then final Agriculture Mitigation and Compensation Plan, and submitted to stakeholders and agencies as outlined below:

- *Agriculture Mitigation and Compensation Plan Framework* - must be developed by July 2016 (one year after the start of construction) and must be submitted to the Peace River Regional District and the District of Hudson's Hope for review.
- *Draft Agriculture Mitigation and Compensation Plan* - must be completed by January 2017 (18 months after the start of construction) and must be provided to affected landowners, tenure holders, Peace River Regional District, District of Hudson's Hope, Ministry of Agriculture, and Ministry of Forest, Lands, and Natural Resource Operations for review.
- *Final Agriculture Mitigation and Compensation Plan* – must be submitted by July 2017 (within two years after construction start) to the BC Environmental Assessment Office, Peace River Regional District, the District of Hudson's Hope, the Ministry of Agriculture, and the Ministry of Forests, Lands and Natural Resource Operations.

6.2. Measure 2: Minimize Access to Agricultural Lands

EAC Condition 30 requires BC Hydro to minimize access to agricultural lands by construction workers and implement measures to minimize unauthorized public access. BC Hydro has prepared the Construction Environmental Management Plan (CEMP) which includes standard construction management mitigation measures. A final CEMP was submitted to government agencies and Aboriginal groups on June 5, 2015 in accordance with EAC Condition 69. The CEMP outlines the requirements for Environmental Protection Plans (EPPs), which must be developed by contractors prior to the commencement of construction activities. These plans include standard management practices for all aspects of construction, including those that may affect agricultural land and operations including traffic management plans and public safety management plans that minimize access to agricultural lands.

6.3. Measure 3: Development of individual farm mitigation plans and compensation measures

EAC Condition 30 requires BC Hydro to :

- *Evaluate effects on agricultural land owners and tenure holders, and develop mitigation and compensation measures consistent with industry compensation standards, to mitigate effects or compensate for losses.*
- *Funding for mitigation actions for disruptions to agricultural land owners and tenure holders.*

- *For impacts that cannot be avoided, the plan will contain an approach for reimbursements that compensate for associated financial losses due to disruptions to agricultural land use.*

The mitigation of the potential effects of the Project on directly impacted private farm operations during and after construction will be included in individual farm mitigation plans. Development and delivery of farm mitigation plans will be led by BC Hydro's Properties Team in conjunction with discussions with land owners whose land may be affected by the Project.

BC Hydro will evaluate effects of the Project through monitoring programs and interviews with agricultural land owners. In some cases when mitigation is not feasible, agricultural land that is required for the Project will be acquired at fair market value, and associated financial losses, including those resulting from effects which are not mitigated, if any, will be reimbursed as described in EIS Section 11.3 Land Status, Tenure and Project Requirements. (BC Hydro, 2013b)

6.4. Measure 4: Management of Surplus Agricultural Lands

EAC Condition 30 requires BC Hydro to include suitable land in the Agricultural Land Reserve in consultation with the Agriculture Land Commission. When residual land parcels are to be sold, consolidate and/or connect residual agricultural parcels with adjacent agricultural land holdings, where practical and when owner(s) and BC Hydro agree.

BC Hydro will responsibly manage lands retained and acquired for use during Site C construction and operations, utilizing land for best use and mixed uses when possible and appropriate. In approximately 15 years, after completion of project construction activities and post-reservoir filling shoreline monitoring, some lands may be identified as surplus lands. BC Hydro will work with Regulators, the Ministry of Agriculture, the Agricultural Land Commission, agricultural stakeholders, and First Nations groups, to consider land use priorities or potential compatible uses (BC Hydro 2015).

Surplus lands determined to be best used for agriculture may be dealt with in several ways. When residual land parcels are to be sold, BC Hydro will make efforts to consolidate or connect residual agricultural parcels with adjacent agricultural land holdings, where practical and when owners agree. BC Hydro will consult with the Agricultural Land Commission and landowners to include suitable land in the Agricultural Land Reserve.

6.5. Measure 5: Establishment of an Agricultural Compensation Fund.

EAC Condition 30 requires BC Hydro to e*stablish an agricultural compensation fund of $20 million for use in the Peace Region or other areas of the province as necessary to compensate for lost agricultural lands and activities, and an approach for establishing the governance and allocation of funds. The EAC Holder must work with the Ministry of Agriculture to establish a governance structure for the agriculture compensation fund that will ensure funds will be used to support enhancement projects that improve agricultural land, productivity or systems.*

BC Hydro is accountable for creating the Fund, and responsible for seeking input from agricultural stakeholders on the fund's objectives, administration, and delivery. BC Hydro has initiated the establishment of a Consultation Steering Committee with members from the Ministry of Agriculture, Ministry of Energy and Mines and BC Hydro to guide consultation with agricultural stakeholders regarding a framework for the Agricultural Compensation Fund. The

framework will provide the basis for a detailed Mandate to direct the Fund's future implementation.

6.6. Measure 6: Develop and Implement Agriculture Monitoring and Follow-up Program

The remainder of this document has been developed in accordance with Condition 31 of the Environmental Assessment Certificate: *The Agriculture Monitoring and Follow-up Program must include at least the following:*

- *Monitoring for Project-induced changes in wildlife habitat utilization, and evaluation of associated crop or feed storage damage for, agricultural operations within 5 km of the reservoir, to assess if there is an increase in wildlife-related crop depredation due to Project-related habitat losses. Monitoring must include pre- and post-reservoir filling field surveys, wildlife monitoring, farm operator interviews, and analysis of relevant records related to wildlife-related crop depredation.*
- *Monitoring for Project-induced changes to humidity within 3 km of the reservoir, and evaluate associated effects on crop drying within this area. Monitoring must include collection and analysis of climate data, calculation of crop drying indices, and farm operator interviews.*
- *Monitoring for Project-induced changes to groundwater elevations within 2 km of the reservoir (the area potentially influenced by groundwater elevation changes), and evaluate associated effects on crop productivity. Monitoring must include field surveys and farm operator interviews.*
- *Monitoring for climatic factors to estimate moisture deficits and to estimate irrigation water requirements in the vicinity of the reservoir to provide information for potential future irrigation projects. Data collection will be undertaken before reservoir filling, and in the 5 years after reservoir filling, and data will be reviewed as required for proposed irrigation projects.*

BC Hydro has prepared draft plans to address the four required monitoring programs identified in Condition 31, including implementation and reporting requirements (Section 7 below).

7. Residual Effects

The implementation of the proposed compensation fund would result in improvements to production on remaining lands and mitigate the loss of current and potential production from permanently lost land. However, there would be a permanent loss of existing farm land, as well as other land with agricultural capability, which would result in a permanent reduction in the agricultural land base of the Peace Agricultural Region and the province. This permanent loss of land, in itself, is considered a significant residual effect.

Considering all aspects of the agriculture VC, an adequately funded and properly administered agricultural compensation fund, by enhancing regional agricultural production and replacing the net agricultural returns that would be displaced from permanently lost land, would mitigate the Project effects on agricultural production and agricultural economies. Therefore the Project's net effect on agriculture is considered not significant. (BC Hydro.2013c)

An Agriculture monitoring and follow-up Program is proposed where the creation of the reservoir may result in site-specific changes that may affect agricultural operations on individual farm operations and where project effects on agricultural operations are not already addressed under agreements with BC Hydro. If site-specific changes do occur, these changes would be detectable in the years immediately following reservoir filling.