SITE C CLEAN ENERGY PROJECT

RESPONSE TO WORKING GROUP AND PUBLIC COMMENTS ON THE SITE C CLEAN ENERGY PROJECT ENVIRONMENTAL IMPACT STATEMENT

Technical Memo

AGRICULTURE

MAY 8, 2013

Subject: Agriculture

Purpose

The purpose of this technical memo is to provide a summary of the agriculture assessment, and to address questions raised during the comment period on the EIS about agriculture. The complete information required by the EIS Guidelines for the assessment of Project effects on agriculture is set out in the EIS, Section 20, and supporting appendices and references.

Comments received during the public and working group comment period on the EIS are answered in the IR response tables, are further supported by this technical memo, and are summarised by BC Hydro in the following general themes:

Changes to Agricultural Land

- characterization of the quality of the land lost to the Project, and consideration of the relative quality of the land remaining in the Peace River valley, the region and the province

Changes to Agricultural Operations

- characterization of the potential effects to individual farm operations, including loss of land and changes to farm management, resulting from Project construction and operation

Estimated Future Agricultural Activity, Without the Project

- characterization of potential future agricultural land use, including food crop production, in absence of the Project, and the assumptions used in development of future crop production scenarios

Local Climate Capability

- potential local weather changes on agricultural land adjacent to the reservoir, and consideration of local microclimates within the valley

Climate Change

- consideration of future potential global climate change scenarios and resultant changes to the regional climate with respect to agricultural land capability

Changes to Food Self-Reliance

- characterization of potential future food production in absence of the Project, in relation to the regional and provincial food self-reliance, and in relation to future climate change

Agriculture Mitigation

- questions about the proposed mitigation programs, including the viability of relocating topsoil from the reservoir area prior to inundation, the viability of potential reservoir water for agricultural irrigation, and the approach to the compensation fund

Introduction

The EIS Guidelines required that the potential for the Project to adversely affect agriculture be assessed by taking into account the potential for the Project to result in changes to the following key aspects

- Loss of agricultural land: An estimate of the loss of agricultural land, including a description of these changes to the agricultural resource base on a local, regional and provincial scale
- Changes to individual farm operations: Description of effects to individual farm operations, including loss of land, effects to farm infrastructure, and changes to farm activities
- Changes to agricultural economies: Quantification of projected immediate and longer-term effects to local, regional and provincial agricultural economies. This included estimating changes in agricultural costs and revenues at the farm level, changes in opportunities for potential new agricultural economic activity, and changes to primary and secondary agricultural economic activity.
- Changes to local food production and consumption: Identification of potential changes to local food production and any changes to the ratio of food production to food consumption (a measure of food self-reliance)

The assessment concludes that considering the effects on these four aspects of the agriculture VC, an adequately funded and properly administered agricultural compensation fund would enhance regional agricultural production and replace the net agricultural returns that would be displaced from forecast agricultural activity on permanently lost land, and would therefore mitigate the Project effects on agricultural production and agricultural economies. For this reason, the Project's net effect on agriculture is considered not significant.

Changes to Agricultural Land

The agricultural assessment met the requirement to estimate the loss of agricultural land by reporting on changes to two measures that characterize the agricultural land baseline: land capability for agriculture and agricultural utlility. Land capability for agriculture is derived from both soil and climate conditions and refers to the potential for agricultural crop production. Land capability is rated on a scale of Class 1 to 7. Agricultural land can be assigned both an unimproved and improved capability rating. Unimproved ratings apply to the cleared, but otherwise natural state of the land, wheras improved ratings apply to the land once improvements, such as irrigation and drainage, have been made.

Table 20.16 in the EIS identifies the permanent loss of land by unimproved capability class (Class 1 – 7), and by Project component or activity. In summary, 3,816 ha of unimproved Class 1 – 5 cultivatable land would be permanently used by the Project and no longer available for agricultural use[1]. The majority (3,225 ha) of this would be within the Site C reservoir area, with 430 ha within other Project component areas, and 161 ha within the erosion impact line[2].

---

[1] EIS, Section 20.3.3.1, page 20.34, lines 4 – 5.

[2] Erosion Impact Line is the predicted extent of shoreline retreat at the maximum normal reservoir level 100 years after impoundment of the proposed reservoir as defined in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports, Part 2 Preliminary Reservoir Impact Lines.

The EIS Guidelines required that the loss of agricultural land be described at a local, regional and provincial scale. Table 20.17 of the EIS (Table 2 of this memo) identifies land by capability class within the Project activity zone, within the local Peace River valley, Peace agricultural region and the Province. The unimproved Class 1 – 5 lands remaining, unaffected by the Project would be:

- 16,240 hectares within the Peace River Valley
- 2,670,460 hectares within the Peace Agricultural Region[3]
- 9,318,297 hectares within British Columbia[3]

Summary of Permanent Loss of Agricultural Land

Table 1 shows the agricultural land that would be permanently lost due to the Project, by improved and unimproved capability class, within the areas of the Project activity zone. This information is presented in EIS Section 20.3.1 Effects Assessment – Construction – Agricultural Land Base, for each Project component and activity, and is summarized for unimproved capability in EIS Table 20.16.

Table 2 shows the agricultural land that would be permanently lost due to the Project within the Project activity zone, by unimproved agricultural capability class, and shows for comparison the areas of total agricultural land in each class within the Peace River valley, the Peace Agricultural Region, and the Province. This information is presented in the EIS Section 20.3.3.1 and summarized in Table 20.17 for unimproved capability.

Table 3 shows the agricultural land that would be permanently lost due to the Project within the Project activity zone, by improved agricultural capability class, and shows for comparison the areas of total agricultural land in each class within the Peace River valley, the Peace Agricultural Region, and the Province.

The improved ratings for the Peace Agricultural Region and the province in Table 3 are based on published information[4], adjusted for the updated improved ratings within the Project activity zone. As described in EIS Volume 3, Section 20, land capability for agriculture mapping in the Project activity zone was updated as part of the Agricultural Assessment program for the EIS. The mapping was updated to account for more recent climatic capability for agriculture ratings, the 1983 climatic capability mapping (BC Ministry of Environment 1983) and analysis of more recent climate data as described in Volume 3, Appendix D, Section 3.0, and soil characteristics determined by the soils field program conducted in 2011 and 2012. Interpretation of the comparison, shown in Table 3, particularly for improved Class 1 areas, must consider the limitations of the previous capability mapping within the Peace River Valley.

Results of the capability updating within the Project activity zone demonstrated lower climatic capability for unimproved ratings than previously estimated, due to a higher moisture deficit than assumed in earlier land capability for agriculture mapping. Conversely the soils in the reservoir area were found to have greater water holding capacity than previously assumed; this resulted in higher improved capability ratings than the ratings assigned in earlier studies. Earlier capability assessments did not

---

[3] Regional and provincial agricultural capability sourced from: British Columbia (B.C.) Environment and Land Use Committee Secretariat. 1976. Agricultural Land Capability in British Columbia. Victoria, B.C.

[4] ibid

note these improved ratings, as the assumed moisture deficit was too small to assign an improved rating with irrigation.

The agricultural capability update showed an increase in the area assigned a Class 1 improved rating within the Project activity zone over previous ratings. Capability updating has not been done for areas of the Peace River Valley outside the Project activity zone. Therefore, if soil and climate capability in other areas of the Peace River Valley are similar to those documented in the updated ratings within the Project activity zone, then there is also a larger area than currently documented of improved Class 1 and 2 in the Valley downstream of the proposed Site C dam. This would result in the improved Class 1 and 2 areas within the Project activity zone representing a smaller percentage of the Class 1 and 2 areas in the Peace River Valley, the Peace Agricultural Region and the province.

Agricultural capability was not constrained by ownership, tenure, current level of development for farming, or the Order-In-Council 2452 Reserve over crown land (commonly known as the flood reserve).

Table 1. Land, in Ha, that Would be Lost Within the Project Activity Zone by Both Improved and Unimproved Agricultural Capability

Project Component or Activity	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6-7	*Class 1-5 sub-total*	*Total*
Reservoir	0	2,290	685	182	68	1,298	3,225	4,523
	(1,412)	(1,300)	(328)	(117)	(68)	(1,298)	(3,225)	(4,523)
Highway	0	149	32	66	1	82	248	330
	(10)	(56)	(57)	(15)	(1)	(82)	(248)	(330)
Erosion	0	87	34	25	15	1,212	161	1373
	(10)	(56)	(46)	(34)	(15)	(1,212)	(161)	(1,373)
Dam site	0	75	29	0	0	61	104	165
	(14)	(61)	(29)	(0)	(0)	(61)	(104)	(165)
Access Roads	0	0	52	7	19	0	78	78
	(0)	(0)	(52)	(7)	(19)	(0)	(78)	(78)
Total	0	2601	832	280	103	2,653	3,816	6,469
	(1,557)	(1,471)	(512)	(173)	(103)	(2,653)	(3,816)	(6,469)

Table 2. Comparison of Unimproved Agricultural Capability Classes, in hectares of the Project activity zone, the Peace River Valley, the Peace Agricultural Region and the Province (reproduced from Table 20.17 of the EIS)

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6-7	*Class 1-5 sub-total*	*Total*
Project Activity Zone	0	2,601	832	280	3,713	2,653	*3,816*	*6,469*
Peace River Valley	926	9,551	6,150	1,949	1,480	35,031	*20,056*	*55,087*
% of Peace River valley	0%	27%	14%	14%	7%	8%	*19%*	*12%*
Peace Agricultural Region	3,833	121,013	365,043	501,036	1,683,351	2,091,078*	*2,674,276*	*4,765,354*
% of Peace Agric Region	0.0%	2.0%	0.2%	0.1%	0.0%	0.1%	*0.1%*	*0.1%*
Province**	21,057	235,480	692,041	1,701,715	6,671,820	20,674,336*	*9,322,113*	*29,996,449*
% of Province	0.0%	1.1%	0.1%	0.0%	0.0%	0.0%	*0.0%*	*0.0%*

Notes:

* Data for Peace Agricultural Region and the Province are from Agricultural Land Capability in British Columbia (BC Environment and Land Use Committee Secretariat 1976). This publication does not explain the difference between areas of unimproved Class 6 and 7 and improved Class 6 and 7 (Table 3), which should be the same.

** The provincial total of approximately 30 million ha is the total area for which Agricultural Capability mapping is available. The total land area of British Columbia is approximately 93 million ha. The 63 million ha not mapped is considered unsuitable for agriculture.

Table 3. Comparison of Improved Agricultural Capability Classes, in ha, of the Project Activity Zone, the Peace River Valley, the Peace Agricultural Region and the Province.

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6-7	Class 1-5 sub-total	Total
Project Activity Zone	1,557	1,471	512	173	103	2,653	3,816	6,469
Peace River Valley	2,483	8,421	5,830	1,842	1,480	35,031	20,056	55,087
% of Peace River valley	63%	18%	9%	9%	7%	8%	19%	12%
Peace Agricultural Region	5,390	119,883	374,271	535,441	1,996,983	1,733,386	3,031,968	4,765,354
% of Peace Agric Region	29%	1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%
Province*	71,504	396,552	999,444	2,131,731	6,138,210	20,259,008	9,737,441	29,996,449
% of Province	2.2%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%

Notes:

* The provincial total of approximately 30 million ha is the total area for which Agricultural Capability mapping is available. The total land area of British Columbia is approximately 93 million ha. The 63 million ha not mapped is considered unsuitable for agriculture.

Local Climatic Capability

The assessment of climatic capability for agriculture is described in Volume 3, Appendix D, Section 3.1 Climatic Capability for Agriculture. The results of the climate assessment were subsequently used in estimating land capability for agriculture as described in EIS Section 20.2.2.1 Land Capability Method of the EIS and shown on EIS Figure 20.2, Maps 1 through 25.

The improved capability ratings shown on EIS Figure 20.2, Maps 1 through 25, reflect the favourable climatic capability of the Peace River Valley. Areas shown as having an improved land capability rating of Class 1 and 2 are, for the most part, areas with a climatic capability of Class 1 and 2 respectively. These highly capable areas are suited for a variety of crops, as described in Section 20.2.3 Agricultural Suitability of Lands of the EIS.

Agricultural Utility

Agricultural utility ratings were assigned to the land to reflect the likelihood of future agricultural cultivation, in absence of the Project. Agricultural utility was classified based on the soil and climate capability of the land (Class 1 to 7), and on potential constraints to agricultural use including land use plans, tenure, location and access, parcel size and configuration, and environmental constraints.

Permanantly lost land was classified by agricultural utility, reflecting the likelihood of these lands becoming used for agriculture in the future, in absence of the Project. Of the 3,816 ha of permanently lost agricultural land (Class 1 – 5), about one- third or 1,299 ha were identified as high utility, and 367 ha were classed as moderate utility, for a total of 1,666 ha of high and moderate utility land lost due to the Project. Within the Peace River valley an estimated 12,527 ha of high and moderate agricultural utility land would remain, unaffected by the Project.

Parcel size, or capability polygon size, was considered only in combination with other constraints, such as access. If small parcels, whether existing or resulting from Project induced fragementation, were rated as having high or moderate utility after consideration of other constraints, they retained that high or moderate utility rating.

Agricultural utility was not constrained by ownership, tenure, current level of development for farming, or the Order-In-Council 2452 Reserve over crown land (commonly known as the flood reserve).

Agricultural Suitability

Crop suitability refers to the suitability of different crops, or groups of crops, potentially grown in different land classes and is a function of the climate, soil capability, and crop needs. Crop suitability does not consider the economic viability of producing crops. The suitability of agricultural lands within the Project activity zone for growing different crops was estimated using the updated land capability for agriculture mapping.

For areas within and near the proposed reservoir, soil characteristics generally do not limit the suitability of most crops and therefore suitability will be primarily dependent on climate. As land capability ratings for the most part reflect climatic capability, suitability of crops were assigned to capability classes following the range of crops considered suitable for the various climatic classes as noted in Climatic Capability Classification for Agriculture in British Columbia (BC Ministry of Environment 1981). For example, the range of crops noted as suitable for a Class 1 climate in the Climatic Capability Classification reference were considered suitable for areas with an improved capability rating of Class 1. Crop suitability by improved land capability class is summarized in Table 20.6 of the EIS.

Table 20.6 provides examples of, and an indication of the range of, crops that can be grown in areas of different (improved) land capability classes within the proposed reservoir area. Crop types are presented as grains and oilseeds, legumes and grasses, annual vegetables, and berries and fruits.Determining the range of crops that could be grown successfully at a specific location would require a site-specific evaluation of soils and climate, which is beyond the requirements of the agriculture assessment for the EIS.

Climate Change

The influence of potential global climate change on future climatic capability for agriculture was assessed using temperature and precipitation anomalies for the 2050s and 2080s, as estimated by the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria[5]. The regional climate change

[5] EIS, Section 20.2.2.1.5, page 20.12, lines 22 – 25.

analysis indicated that climate capability for agriculture within the region as a whole would improve, increasing the land capability for agriculture throughout the region.

Section 20.2.2.1.5, page 20.12, Regional Climate Change states:

Applying the PCIC climate change model temperature anomaly projections, statistically significant changes to growing degree-days and frost-free periods are expected, and as a result, a significant improvement in climatic capability for agriculture is predicted. Improved climatic capability in the vicinity of the reservoir would generally improve from Class 2 and 3 to Class 1. The effect would be an increase in the area of land with a land capability rating of Class 1.

Climate change predictions also indicate that climate capability within the region as a whole would improve, increasing the land capability for agriculture throughout the region. It is expected that the relative proportion of high capability land within the Project activity zone relative to the total within the region would not increase with climate change, and may decrease. As indicated in the EIS, results for land capability for agriculture, the region will have up to 2,670,460 ha of remaining (unimproved) Class 1 – 5 land, of which 486,456 ha is Class 1 – 3, land that may experience an overall improved capability under the global climate change scenarios.

Changes to Agricultural Operations

The assessment of changes to individual farm operations is based on interviews with farm owners or operators and discussions with regulatory agency personnel, as well as on the predicted changes in microclimate described in Volume 2 Section 11.10.

Potential changes which were identified are summarized in Volume 3, Section 20, Table 20.25 for farm operations which would be directly affected. Identified effects include the loss of land and crop production, soil disturbance, and effects on farm infrastructure, water supplies, livestock access to the reservoir, access to and within farms, fencing and livestock movement and severance and fragmentation of farm properties.

An estimated 541 ha of currently cultivated land, and 1183 ha of land within current grazing licence or lease areas, would be premantly lost.

Predicted changes to microclimate were assessed and it was concluded that, for agricultural land near the reservoir, agricultural productivity may increase due to a longer growing season but that there may be adverse effects to crop drying. Monitoring of climate parameters affecting crop drying is proposed to evaluate this potential effect. No changes are predicted for winter wind chill effects on livestock, irrigation water requirements, overwintering perennial crops or on field trafficability.

The majority of the farms identified as being affected by the Project would have only part of their farm area affected, and would be able to continue farm operations, as described in sections 20.3.5.2 and 20.3.5.3 of the EIS.

Estimated Future Agricultural Operations and Economic Activity, Without the Project

The major changes to agricultural economic acitivity would be associated with the foregone economic activity that results from the loss of agricultural land. Section 20.3.8 of the EIS estimates the net present value of potential agricultural production as the value of foregone agricultural economic activity that

may have occurred from land within the Project activity zone under different land use scenarios within 100 years of the estimated first year of Project construction.

The analysis of foregone agricultural economic activity includes a number of assumptions including: 1) future agricultural development, 2) the period over which development (agricultural expansion) takes place, 3) annual real growth rate in the agricultural terms of trade, 4) foregone benefits period, and 5) discount rate, all of which are described in Volume 3, Appendix D, Agricultural Economic Valuation Methodology.

Potential future agricultural land use without the Project was estimated using a number of assumptions[6]. The level of future agricultural development was not constrained by current or assumed future ownership, tenure, including the current level of development for farming, or the Order-In-Council 2452 Reserve over crown land (commonly known as the flood reserve). It was assumed that:

- The currently cultivated land would continue to be farmed
- The currently unused Class 1 through 5 high to moderate utility lands would become fully developed for cultivation over time
- The currently unused Class 1 through 5 low utility lands would become fully used for grazing over time
- 50% of the Class 6 and 7 lands would become fully used for grazing over time

The economic value of the agricultural activity that would be displaced by the Project was derived using the methodology described in Volume 3, Appendix D, Section 6 Agriculture Economic Methodology, page 47, which was largely based on the valuation methodology first used by the BC Ministry of Agriculture Blue Paper (BCMAF 1982) in its review of the previous Site C agricultural assessment.

Three alternative scenarios of the pattern of future agricultural development were considered, and the total area in crops and the area of grazing increase to the amounts shown in Table 20.31 for each scenario:

- Scenario 1 is based on expansion of the current cropping mix, with no new crop types added
- Scenario 2 is identical to Scenario 1, except that vegetable production, increasing to 100 ha by year 100, is included. The vegetable production is assumed to supplant an equal area of other crops. This scenario is employed in the base case evaluation of foregone agricultural activity
- Scenario 3 is identical to Scenario 2, except that vegetable cropping reaches 200 ha by year 100, supplanting an equal area of other crops

Although vegetable production has not increased over the past 30 years, vegetables remain a potential high value use of the land in the future and have been included as part of the future crop mix. Future cropping scenarios which include 100 ha and 200 ha of vegetables have been used to estimate the present value of the returns to agricultural land within the Project activity zone without the Project, as described in Section 20.3.8.4 Agricultural Economic Activity Without the Project of the EIS. The expansion of vegetable production to this extent is reasonable given that in 2011, there were 28 ha of vegetable and potato production in the entire Peace Agricultural Region (Statistics Canada 2012a).

[6] EIS Section 20.3.8.2 Agricultural Land Use Without the Project.

Current agricultural land use is approximately 1,724 ha, comprised of 541 ha of cultivated land and 1,183 ha of grazing land within the Project activity zone[7]. For the purposes of the assessment, future projected agricultural land use without the Project, over the next 100years within the Project activity zone, is assumed to increase by three-fold to a total of 5,143 ha, comprised of 1,666 ha of cultivated land (based on the agricultural utility rating), and 3,477 ha of grazing land (EIS section 20.3.8.2).

The estimated present value (Year 1 dollars) of the foregone economic activity associated with the future projected agricultural land use without the Project, over the next 100 years, is estimated at between $13 million and $31.5 million, with the base case (Scenario 2) estimated at $22.3 million (EIS section 20.3.8.3).

Additional economic considerations in the agriculture assessment include changes to regional agricultural economic activity and employment. The currently farmed portions of the Project activity zone are estimated to produce approximately 0.2% of the current regional gross farm receipts. Depending on the cropping scenario assumed, if all the high and moderate utility land were cultivated today, and with some grazing use in the remainder of the Project activity zone, the gross farm receipts from land within the Project activity zone would represent between 0.7% through 1.3% of the current regional gross farm receipts, depending on the cropping scenario assumed. This estimate assumes no increase in gross farm receipts in the remainder of the region.

Agricultural economic considerations also include changes to farm employment. As described in Section 20, it is estimated that current paid employment in the Project activity zone, based on an estimate of 49 weeks of employment per year per full-time worker, is about 1 to 2 person-years (2012a). Considering the future base case agricultural development scenario, it is estimated that paid employment in the Project activity zone could rise to 3 to 4 person-years annually without the Project.

Changes to Food Self-Reliance

The EIS Guidelines required the consideration of changes to local food production, and thus consideration of food self-reliance as a function of food production and consumption. Baseline conditions identified a decreasing trend in food self-reliance in British Columbia due to globalization, increased trade and changes in government regulation.

EIS Section 20.2.9.1 states that Canada supports fair trade rules and environmentally sustainable trade practices as the means toward increasing food security, rather than agricultural protectionism and promotion of food self-sufficiency. In B.C. residents benefit from access to reasonably priced, high quality, imported food year-round, and producers face relatively low returns associated with growing most food products in the province.[8] As such, the level of current food self-reliance is a function of market dynamics as farmers seek the most economical crops to grow and enterprises to operate, and consumers seek economic, year-round access to produce[9].

The EIS considers potential changes to regional food self-reliance with the Project based on the ratio of food production to food consumption for relevant, locally-produced food commodities. The analysis confirms high levels of regional self-reliance in grains, oils and fats, sugars, and red meats and low

---

[7] EIS Section 20.3.5 Effects Assessment – Construction - Agricultural Operations; Table 20.26 Summary of Loss of Cultivated Land by Operation, and Table 20.27 Permanent Land Losses Grazing Tenures.

[8] EIS, Volume 3, Appendix D, Section 7.1.2.2, page 64.

[9] EIS, Volume 3, Appendix D, Section 7.1.2.2, page 64.

levels of self-reliance in dairy, poultry, and vegetables. Increased self-reliance in dairy and poultry would not require higher capability farmland to support increased production, if economic conditions were to encourage such a trend.[10] For vegetables, sufficient high capability agricultural land would remain in the Peace River valley to support higher levels of regional food self-reliance.

Section 20.3.11.2 states that the Peace Agricultural Region population, projected out to the year 2036, is anticipated to grow at an average annual rate of about 1.09% (BC Stats No date). Extrapolating that rate over the next 100 years, the Peace Agricultural Region population may grow to approximately 210,000 people in 2112, or about triple what it is today.

Assuming food consumption patterns do not change appreciably into the future, Table 20.36 shows that future regional vegetable consumption would also be expected to triple. A 50% self-reliance in vegetables capable of being grown in the Peace Agricultural Region would require approximately 755 ha of vegetable production in 2112, and a 100% self-reliance would require approximately 1,510 ha of vegetable production.

Table 4. Peace Agricultural Region Population Growth in Relation to Food Self-Reliance in Vegetables to 2112

Year	Peace Region Population[a]	50% Self-Reliance	100% Self-Reliance
		Vegetables Required (ha)[b]	
2011	71,000	255	511
2036	93,100	335	670
2062	122,100	439	878
2112	209,900	755	1,510

NOTES:

[a] BC Stats (No date)

[b] Refers to self-reliance in vegetables that can currently be grown in the Peace Agricultural Region

In summary, for vegetable crops that are climatically adapted, it is anticipated that if the Project proceeds, there will be more than adequate land outside of the Project activity zone to meet self-reliance needs at least for the next 100 years. Of the 9,778 ha within the Peace River Valley rated as having high utility outside of the Project activity zone, 6,606 ha have an unimproved capability of Class 1 and 2, and 3,172 ha of Class 3.

Changes in food self-reliance in relation to climate change:

A number of public comments ask how the agriculture assessment has considered future potential climate change. EIS section 20.2.2.1.5 describes the impact of potential global climate change on future climatic capability for agriculture. Volume 3, Appendix D, Section 7.1.2.3, page 65, provides the following information regarding anticipated changes in provincial food self-reliance in relation to climate change:

[10] EIS, Section 20.3.11.2, page 20-65, lines 15 – 37.

> *It is expected that global climate change will change the conditions for agriculture within regions of the province. According to a climate change action plan prepared by the provincial Ministry of Agriculture and Land (BC Agriculture and Food 2010):*
>
> "Some research predicts BC will experience increasing agricultural capability and a broader range of suitable crops. However, it is likely that climate change will increase uncertainty and the costs associated with weather damage for BC's agricultural operations."
>
> *The direction of the potential net effect of climate change on provincial food self-reliance has yet to be determined. There is concern that the current world food supply system will be disrupted by climate change, creating global food security issues. With appropriate provincial and federal food strategies,[11] B.C.'s food self-reliance could increase if the agricultural sector takes a more prominent role in the global food supply system.*

The region's future ability to supply food, both within the region and outside the region, would continue to be supported, even with the Project, because the anticipated increase in the frost-free period and the number of growing degree days will increase the agricultural capability, and therefore the potential for agricultural production, on the approximately 2,670,460 ha of remaining (unimproved) Class 1 – 5 land.

The proposed agricultural compensation fund could be used to support research into on-farm and regional adaptation to support agricultural production in response to climate change.

Agriculture Mitigation

EIS, Section 20.4 of the agricultural assessment summarises the effects and proposed mitigation measures, whereas there is more description on the proposed mitigation measures in each preceding effects assessment sections. Generally mitigation focuses on maintaining or increasing agricultural productivity on lands not directly affected by the Project. Agricultural mitigation measures can be categorized as standard best management practices, direct on-farm mitigation, and the proposed agriculture compensation program.

Standard Management Practices

BC Hydro would implement suitable management practices for all aspects of construction, including those that would affect agricultural land. Examples of standard management practices relevant for reducing effects on nearby or adjacent farm operations include dust control, noxious weed control, erosion and sediment control, all of which will be supported by management plans as described in Section 35 of the EIS.

[11] These responses include making strategic adaptations that increase the tools available to agricultural producers to manage climate change and adopting mitigation measures to reduce agriculture's carbon footprint while creating economic opportunities for doing so.

Direct On-Farm Mitigation

Direct mitigation at the farm level would be included in farm-specific mitigation plans focused on avoiding, reducing or compensating for direct adverse effects on agricultural land and operations, including management of on-farm impacts, such as changes to farm access, buildings, wells or fencing.

Top Soil Removal

BC Hydro would salvage and store surface soils from temporary construction areas for later use in reclamation of these areas[12]. Environmental management plans would be developed to support BC Hydro's proposed soil relocation activities.

Within the reservoir area, BC Hydro has proposed that localised soil relocation would be considered on a site-specific basis as a component of farm specific mitigation plans. Surface soils of suitable quality, salvaged from areas that would be inundated or from areas disturbed by Highway 29 relocation works, could be placed in nearby areas of poorer quality soil or in low-lying, poorly drained areas to improve agricultural productivity[13].

Large scale topsoil removal and relocation is not proposed by BC Hydro because there are a number of environmental constraints to this activity. However, during the construction period there would be adequate time for interested third parties (e.g. oil and gas industry) to evaluate the impacts and benefits of topsoil removal and to develop an environmental management protocol for such activities in discussion with relevant provincial regulatory agencies. If suitable protocols can be developed, BC Hydro would be supportive of third party topsoil removal prior to reservoir flooding.

Opportunities to implement topsil relocation at a large scale would have to consider the following issues[14]:

- Disturbance of archaeological sites – the potential for archaeological site disturbance due to soil relocation must be evaluated and managed in consideration of the Project Heritage Management Plan and may need further Site Alteration Permits under the Heritage Conservation Act. This disturbance would be of a different nature than inundation by the reservoir.
- Erosion and sediment control – the removal of additional vegetation and root structures would be required to allow access to and relocation of surface soils. This would expose underlying materials to associated erosion, sedimentation effects, and invasive plant species. These effects would need to be evaluated and managed in a manner consistent with the Project Erosion Prevention and Erosion Control Plan as well as the Soil Management, Site Restoration, and Re-vegetation Plan.
- Weed control – the relocation of surface soils with associated invasive weed seed caches must be evaluated and managed in a manner consistent with the Project Vegetation and Invasive Plant Management Plan.
- Habitat degradation – the removal of additional vegetation cover to allow access to and relocation of surface soils would remove additional terrestrial habitat features.

---

[12] ESI, Section 20.3.4.1.2, page 20-43, lines 11 – 13.
[13] EIS, Section 20.3.4.1.2, page 20-42, lines 39 – 41.
[14] ESI, Section 20.3.4.1.2, page 20-43, lines 3 – 5.

- Release of mercury – the methylmercury studies in the EIS have identified that the natural background mercury is largely concentrated in the organic soils. Therefore the potential effects of soil relocation on the methylmercury would need to be assessed, to understand how soil removal may change the methylmercury effects predicted in this EIS.

Reservoir Water Quality for Irrigation

EIS, Section 20.3.4.1.2 describes the potential for irrigation improvements using water from the reservoir. The reservoir water quality would be adequate for irrigation purposes, as water quality within the reservoir would be within drinking water quality guidelines, as described in EIS, Section 33.

Agricultural Compensation Program

EIS, Section 20.3.10.1.1 describes the agricultural compensation fund proposed to mitigate the agricultural economic activity that would be foregone due to the loss of agricultural land. BC Hydro will establish an agricultural compensation fund to support Peace River valley and regional agricultural projects. Funded projects would be those that would enhance or improve agricultural production on a local and regional scale.

The administration and governance of the fund, and the magnitude of the fund, will be developed through consultation with agricultural organizations, the Agricultural Land Commission (ALC), the B.C. Ministry of Agriculture, and the local agricultural community.

There are many opportunities to improve or enhance agricultural production in the region. The actual projects funded would be those proposed by agricultural stakeholders, and supported by detailed proposals and clear objectives. Types of projects that the proposed fund may support are listed below. Some of these projects already receive funding assistance from existing programs:

- Agricultural Land Base Improvements
  - Provide funding to implement shelterbelt or windbreaks to supplement the B.C. Agricultural Council Environmental Farm Plan program
  - Provide funding to implement alternative cattle watering systems that limit direct animal access to riparian areas to supplement the Environmental Farm Plan program; this could result in improved systems with respect to reliability and water quality in addition to environmental benefits
  - Provide funding to implement fencing schemes to better manage grazing lands and improve riparian function in an environmentally sustainable fashion to supplement the Environmental Farm Plan program
  - Provide assistance in improving or expanding the use of Crown land for grazing, including community pastures
  - Provide funding for developing methods for improving the grazing capacity of cut blocks
  - Provide funding for fencing for wildlife control, particularly to protect feed storage areas
  - Assist in expanding the agricultural land base in Fort Nelson; assistance in land use planning for the area may be a possibility
  - Support regional weed management initiatives to supplement existing weed management programs

- Support for agricultural research and development
  - Support research and demonstration to promote adoption of irrigation technology
  - Support research and demonstration to increase yields and commercialize new crops and varieties (e.g., vegetables, specialty crops, biofuels)
  - Support research into on-farm and regional responses to climate change (e.g., perennial cereals, drought-resistant varieties)
  - Support extension activities, demonstration projects, and variety trials, focusing on transfer of knowledge to the farming or ranching sector
  - Support demonstration of advanced fertility management (e.g., liming, crop nutrition, nitrogen-fixing rotations)
  - Support demonstration of new production techniques
  - Support research into, and demonstration of, weed and disease control measures
- Support and accelerate regional value-added initiatives in the agricultural sector
  - Support feasibility studies of potential opportunities such as regional food processing, slaughter capacity, bioproducts (e.g., from hemp, Russian dandelion, Jerusalem artichoke), and nutraceuticals; if such potential opportunities appear feasible, support implementation
  - Support local marketing initiatives
  - Create markets for local agricultural products (e.g., food for construction workers during project construction), including support for local farmers' markets
  - Support local market infrastructure development such as cleaning and packing, warehousing and storage, and distribution
  - Support attraction of investment into agricultural value-added opportunities
- Improve the sustainability of the agricultural sector
  - Support investigation into carbon credit opportunities for agriculture
  - Assist adoption of green and alternative technologies in place of fossil fuel-driven energy systems to supplement the Environmental Farm Plan program
- Improve regional infrastructure such as facilities, services, and installations in support of agriculture
  - Develop irrigation infrastructure
  - Develop regional transportation network
  - Improve the regional electrical grid
  - Improve access to natural gas
  - Develop regional agricultural and domestic water supply plans
  - Facilitate clean energy agricultural hook-ups to the grid
- Assist in improving access to the Internet and cellphone coverage

Conclusion

The EIS Guidelines required that the potential for the Project to adversely affect agriculture be assessed by taking into account the potential for the Project to result in changes to four key aspects.

- Loss of agricultural land: There would be a permanent loss of agricultural land as a result of the Project. However, BC Hydro proposes to establish a compensation fund to support Peace River valley and regional agricultural projects targeted at improving production on remaining lands and at

enhancing agricultural economic activity in the region. The fund will provide resources to increase agricultural production on remaining lands over a period of time.

- Changes to individual farm operations: The majority of farms would have only part of their land affected and would continue to operate. Farm Mitigation Plans will be developed in consultation with each owner and operator, that will describe appropriate mitigation measures to address specific effects for each operation. Agricultural land required for the Project will be acquired and associated financial losses (if any) will be fairly compensated.
- Changes to agricultural economies: The Project would result in foregone agricultural economic activity compared to potential future agricultural land use. BC Hydro's proposed compensation fund would mitigate this effect as the design and amount of the fund would be structured to mitigate adverse effects on agricultural economic production.
- Changes to local food production and consumption: There would be no effects on regional food self-reliance, as there would be sufficient land remaining for the region to be self-sufficient in commodities that can be produced in the region.

Considering all aspects of the agriculture VC as outlined in the introduction, 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.

References:

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

Related Comments / Information Requests:

This technical memo provides information related to the following Information Requests:

• Response to Peace Valley Environmental Association Standard Letters • Response to Wilderness Committee Standard Letters • Response to Greenhouse Gas Emission Standard Letters			gov_0002-004	gov_0004-015
gov_0004-016	gov_0005-026	gov_0010-629	gov_0010-640	gov_0010-641
gov_0010-642	gov_0010-643	gov_0010-647	gov_0010-667	gov_0010-668
gov_0010-679	pub_0001-001	pub_0011-001	pub_0022-001	pub_0030-001
pub_0040-001	pub_0050-001	pub_0052-001	pub_0056-001	pub_0058-001
pub_0064-004	pub_0065-001	pub_0066-001	pub_0088-001	pub_0115-004
pub_0173-001	pub_0176-001	pub_0191-001	pub_0203-001	pub_0218-001
pub_0223-008	pub_0225-001	pub_0234-001	pub_0236-002	pub_0236-003
pub_0236-004	pub_0236-005	pub_0236-008	pub_0236-009	pub_0236-011

pub_0236-012	pub_0236-014	pub_0236-015	pub_0236-016	pub_0236-017
pub_0240-001	pub_0243-006	pub_0245-005	pub_0246-004	pub_0249-001
pub_0250-001	pub_0252-001	pub_0256-001	pub_0258-001	pub_0291-001
pub_0293-001	pub_0295-001	pub_0376-001	pub_0380-001	pub_0407-001
pub_0438-021	pub_0448-004	pub_0448-ag-004	pub_0448-ag-007	pub_0448-ag-010
pub_0448-ag-011	pub_0448-ag-012	pub_0448-ag-015	pub_0448-ag-016	pub_0448-ag-017
pub_0448-ag-018	pub_0448-ag-019	pub_0448-ag-020	pub_0448-ag-022	pub_0448-ag-023
pub_0448-ag-024	pub_0448-ag-026	pub_0448-ag-027	pub_0448-ag-032	pub_0448-ag-057
pub_0448-ag-088	pub_0448-ag-121	pub_0448-ag-125	pub_0457-003	pub_0472-004
pub_0473-001	pub_0479-002	pub_0482-001	pub_0498-001	pub_0508-001
pub_0509-001	pub_0510-001	pub_0514-001	pub_0519-001	pub_0538-001
pub_0543-001	pub_0563-001	pub_0565-001	pub_0573-001	pub_0584-001
pub_0592-001	pub_0594-001	pub_0598-001	pub_0599-001	pub_0600-004
pub_0603-001	pub_0605-005	pub_0606-001	pub_0607-001	pub_0617-001
pub_0636-001	pub_0653-001	pub_0657-001	pub_0673-001	pub_0693-001
pub_0702-001	pub_0706-001	pub_0710-001	pub_0714-001	pub_0715-002
pub_0727-001	pub_0728-001	pub_0742-001	pub_0750-001	pub_0777-001
pub_0795-001	pub_0837-001	pub_0841-001	pub_0844-001	pub_0846-001
pub_0847-001	pub_0852-001	pub_0855-001	pub_0859-001	pub_0863-001
pub_0893-001	pub_0897-001	pub_0910-001	pub_0912-001	pub_0941-001
pub_0943-001	pub_0947-001	pub_0952-001	pub_0961-001	pub_0963-001
pub_0965-001	pub_0975-001	pub_0985-001	pub_0988-001	pub_0992-001
pub_1014-001	pub_1018-001	ab_0007-003		