20 AGRICULTURE

20.1 Approach

Agriculture is an important component of the economy in the Peace region. The effect of the Project on the valued component (VC) of agriculture is assessed considering the interactions between the Project and the four key aspects of agricultural land base, farm operations, the agricultural economy, and food production and consumption.

20.1.1 Regulatory and Policy Setting

Some of the land that would be temporarily or permanently occupied by the Project is in the province's Agricultural Land Reserve (ALR), and would need to be approved as either "non-farm use" or the lands would need to be excluded from the ALR. The ALR is managed in B.C. under the *Agricultural Land Commission Act* (S.B.C., 2002).

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.

20.1.2 Key Issues and Identification of Potential Effects

Issues, concerns, and interests identified during consultation with the public, Aboriginal groups, and government agencies guided the scope of the agriculture assessment (see Volume 1 Section 9 Information Distribution and Consultation).

Project interactions with agriculture could potentially cause the following effects:

- 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

The key issues identified and the approaches used to address issues are outlined in Table 20.1.

Table 20.1 Key Issues: Agriculture

Key Issues	Approach to Addressing Key Issues
The potential for the Project to result in the loss of agricultural land	The agriculture assessment considers the temporary and permanent use of agricultural land for the Project
Agricultural capability of land in the Peace River valley, taking into consideration climate, soil, and the suitability of land for food crops	The agriculture assessment baseline conditions describe land capability for agriculture, which has been updated with current fieldwork and technical analysis of soil conditions, climate conditions, and crop suitability
The need for the assessment to include all Project activities and areas	The agriculture assessment is undertaken for the complete Project activity zone and consideration of areas within the impact lines
The impact of the flood reserve on current use of land for agricultural purposes. Assessment should consider potential use, as current use is minimal due to non-farmer ownership, not due to land potential or suitability.	The agriculture assessment takes into count lands both currently developed and undeveloped for agricultural uses, by considering land capability (irrespective of current use)
Local, regional, and provincial food production and food security	The agriculture assessment takes into account how the Project would affect the food self-reliance in the region for crops suitable to the region
Effects on farmers, farm operations, and farm access, including project benefits for increased agricultural use	The agriculture assessment takes into account effects on farm operations. Volume 2 Section 11.3 Land Status, Tenure, and Project requirements addresses the Project approach to land requirements.
Consider climate capability and irrigation potential. Consider future land capability considering climate change as it relates to agricultural use. Consider irrigation potential.	The local climate was considered in the determination of current baseline conditions for land capability for agriculture ratings Irrigation potential is considered in the improved land capability ratings as the key improvement that would overcome the natural climatic moisture deficit Consideration of possible future changes to climatic ratings is based on regional climate change scenarios for 2050 and 2080
Potential for increased wildlife crop damages	The agriculture assessment considers the potential for increased wildlife damage to crops

Potential project interactions with agriculture are summarized in Volume 2 Appendix A Project Interaction Matrix, Table 2. A “2” ranking in Table 2 indicates where interactions may result in an adverse effect, and the nature of the effect or the effectiveness of mitigation measures are uncertain. Therefore, they require analysis and evaluation in the environmental assessment. Project interactions with a ranking of “2” are summarized in Table 20.2 below.

Table 20.2 Interactions of the Project With Agriculture

Project Activities and Physical Works	Key Aspects			
	Loss of agricultural land	Effects on individual farm operations	Change to the agricultural economy	Changes to regional food production and consumption
Construction				
Dam and Generating Station Construction	✓	✓	✓	✓
Reservoir preparation and filling	✓	✓	✓	✓
Transmission system	✓	✓	N/A	N/A
Quarried and Excavated Material Source Development				
▪ Wuthrich quarry	✓	✓	N/A	N/A
▪ Del Rio granular borrow	✓	✓	N/A	N/A
▪ Other Sources | Granular borrow (within inundation zone, along Highway 29)	✓	✓	N/A	N/A
▪ Other Sources | Area E	✓	✓	N/A	N/A
▪ 85th Avenue Industrial Lands till source conveyor belt	✓	✓	N/A	N/A
Highway 29 realignment	✓	✓	✓	✓
Construction Access Road Development				
▪ Transmission line access roads	✓	✓	N/A	N/A
▪ Jackfish Lake Road works	✓	✓	✓	✓
▪ Old Fort Road realignment, extension of 240 and 269 Roads	✓	✓	✓	✓
▪ Septimus Rail Siding construction	✓	✓	✓	✓
Worker Accommodation Construction and Operations				
▪ Temporary Accommodation – Northern Regional Site[a] (Halfway-Farrell)	✓	✓	N/A	N/A
▪ Temporary Accommodation – Southern Regional Site[a] (Jackfish Lake Road)	✓	✓	N/A	N/A
Operations				
Transmission Line Operations				
▪ Right-of-way vegetation maintenance	N/A	✓	N/A	N/A
▪ Maintenance of access roads	N/A	✓	N/A	N/A

NOTES:

[a] Location of temporary northern and southern region worker camps not yet determined

Only Project interactions ranked as "2" in Volume 2 Appendix A Project Interaction Matrix, Table 2 are carried forward to this table. A ✓ indicates that a project component or activity is likely to interact with the VC

N/A – not applicable

20.1.3 Standard Mitigation Measures and Effects Addressed

A “1” ranking in Table 1 in Volume 2 Appendix A Project Interaction Matrix, Table 2 means that an interaction with agriculture will occur; however, the effects of such interactions are well understood and can be avoided or mitigated through the application of standard mitigation measures. Therefore, no further analysis and evaluation is required in the environmental assessment. A “1” ranking was assigned to the transportation of construction materials and supplies at the dam site, transportation of merchantable timber away from the reservoir, supply and transportation of goods and services for dam site camps, and West Pine quarry access because interactions with agriculture would occur but would be managed through the Traffic Management Plan.

As described in Volume 5 Section 35 Summary of Environmental Management Plans, BC Hydro will prepare a Traffic Management Plan for the Project’s construction phase that will include applicable access restrictions to, and traffic control of, land, roads and railway corridors. Project-induced increases in operation costs associated with access, traffic and mitigation options would be discussed with affected landowners and, where appropriate, agreements would be entered into, as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

Excluding those project activities and works described above as having been given a ranking of “1” or “2”; all other project activities and works listed in Table 2 of Volume 2 Appendix A scored a “0” or were not applicable, meaning that there is no potential interaction. As noted in Table 2 of Volume 2 Appendix A, these activities are minor works and activities that do not interact with agriculture, or are evaluated at the Project or component level.

20.1.4 Selection of Key Indicators

The key indicators for assessing Project effects on agriculture and the rationale for their selection are shown in Table 20.3.

Table 20.3 Key Indicators for Agriculture

Key Aspects	Key Indicators	Rationale for Selection of the Key Indicators
Loss of agricultural land	• Land capability ratings (soil and climatic capability) • Crop suitability • Agricultural land use and Crown land tenures • Agricultural utility (reflects relative likelihood of cultivation)	The key indicators will be used to estimate the effects of temporary and permanent loss of agricultural land. The change in agricultural land use and Crown land tenures will provide amounts of agricultural land lost. Land capability, which is the commonly accepted measure of the relative agricultural productive value of land, crop suitability, and agricultural utility, provides measures of the agricultural productive value of the lost land. Land capability ratings are described by the Agricultural Land Commission.
Effects on individual farm operations	• 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 • Farm worker safety • Reservoir-induced changes to microclimate on adjacent agricultural operations • Changes to wildlife presence in agricultural areas	The key indicators together describe potential effects on individual farm operations
Change to the agricultural economy	• Agricultural costs and revenues at the individual farm level • Primary agricultural economic activity • Opportunities for potential new agricultural economic activity • Secondary agricultural economic activity	The key indicators can be used to quantify projected effects to local, regional, and provincial agricultural economies
Changes to regional food production and consumption	▪ Regional food production ▪ Regional food consumption	The key indicators will identify potential changes to regional food self-reliance by estimating changes to food production compared to food consumption of regionally suited crops

20.1.5 Spatial and Temporal Boundaries

20.1.5.1 Spatial Boundaries

The Local Assessment Area (LAA) in the EIS Guidelines for the assessment of the VC of Agriculture is the Project activity zone and the Peace River valley between the Peace

Canyon Dam and the Alberta border. The Regional Assessment Area (RAA) in the EIS Guidelines is the Peace River Regional District Peace River Census Division (Census Division 55, Agricultural Region 8).

The areas used for reporting in this assessment were updated from the originally proposed spatial boundaries in the EIS Guidelines. The agricultural land LAA used in this agriculture assessment for reporting on changes to the agricultural land base and changes to individual farm operations is the Project activity zone and the remainder of any farm operations that are within the Peace River valley and that overlap the Project activity zone. The agricultural economy LAA for changes to agricultural economic activity and changes to food production and consumption was expanded to include the Peace River Regional District and the Northern Rockies Regional Municipality, which comprise the Peace River Agricultural Region (Statistics Canada Agricultural Region 8, Statistics Canada 2012a). This wider area coincides with the reporting areas on agricultural economic activity.

The RAA for all components of this assessment is the Peace River Regional District and the Northern Rockies Regional Municipality, which comprise the Peace River Agricultural Region, Statistics Canada Agricultural Region 8 (Statistics Canada 2012a).

Figure 20.1 shows the boundaries of the agricultural LAAs and the RAA.

20.1.5.2 Temporal Boundaries

Project components and activities that could affect agriculture would occur during the construction and operation phases of the Project. Agricultural resources located within the agricultural land and economy LAA would be affected in Years 1 through 8 during the construction phase and throughout the operating life of the Project. Effects related to the operations phase would begin in Year 8 and may continue through the operating life of the Project.

20.2 Methodology and Baseline Conditions

In accordance with the EIS Guidelines, the agricultural assessment baseline data collection included information on the following:

- Agricultural land capability ratings, using updated field observations or existing provincial mapping, and updated climatic capability using current climate data
- Agricultural suitability of lands within the Project activity zone for growing different crops, determined using updated or available capability ratings and rated as well suited, suited, or not suited for various crops
- Agricultural utility ratings, to reflect the likelihood of each area being used for agricultural production in the future, based on land capability ratings, as well as constraints on agricultural use (such as location, access, parcel size, landownership or tenure, and land use plans or designations)
- Agricultural land use, determined from recent air photos of the Project area, Crown land tenures, field observations, and interviews with landowners and operators
- Agricultural tenure on Crown lands, including range tenures and grazing licences, determined from provincial data sources, within and near the Project activity zone
- Current and expected future agricultural operations and practices, determined through interviews with owners and operators of potentially affected agricultural

operations, as well as through review of agricultural census information for the agricultural economy LAA

- Local and regional agricultural economic activity, determined through interviews with owners and operators, relevant agricultural associations, representatives of agriculturally related industries, and representatives of government agencies
- Local and regional food production and consumption estimates, determined through interviews with owners and operators of potentially affected agricultural operations, relevant agricultural associations, representatives of agriculturally related industries, and representatives of government agencies

The key sources resulting from a literature review are discussed below, followed by a summary of fieldwork and analysis used and a description of the baseline conditions. Details on the methodology are described in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.2.1 Literature Review

A complete list of information sources used in this assessment is provided in the References at the end of this section. Key information sources used to define baseline conditions for agriculture in the study area are listed below.

The key information sources on soils were as follows:

- *Soils of the Fort St. John–Dawson Creek area, British Columbia* (Lord and Green 1986)
- 1:40,000 digital orthophotograph base (2007)
- 1:5,000 scale orthophotographs (2010)
- LiDAR Digital Elevation Model

The key information sources on land capability for agriculture in the Project activity zone were as follows:

- Peace River Site C Hydroelectric Development Agriculture Assessment (CBRC 1979)
- Determination of the Aerial Extent of Lands with Agricultural Capability Class 1 to 5 within the Proposed Site C Reservoir Area (Pottinger 1982a)
- Manuscript Maps Used for Determination of the Aerial Extent of Lands With Agricultural Capability Class 1 to 5 Within the Proposed Site C Reservoir Area (Pottinger 1982b)
- Land Capability Classification for Agriculture in British Columbia (Kenk and Cotic 1983)
- Site C Agricultural Resources Inventory: Status of Information and Recommendations for Further Study (Norecol 1991)
- Site C Project Environmental Resource Atlas (Hugh Hamilton Ltd. 1991)
- *Soils of the Fort St. John–Dawson Creek Area, British Columbia* (Lord and Green 1986)

- Canada Land Inventory Land Capability for Agriculture maps. 1:50,000 scale. Agriculture Canada. Undated. These maps were produced from the early- to mid-1970s.

Sources of information and land use planning within the Project activity zone, used to develop agricultural utility ratings, included the following:

- The Dawson Creek Land and Resource Management Plan (B.C. Ministry of Forests, Lands and Natural Resource Operations 1999)
- The Fort St. John Land and Resource Management Plan (B.C. Ministry of Forests, Lands and Natural Resource Operations 1997)
- Peace River Regional District Zoning By-laws and Maps (Peace River Regional District 1996, 2001)
- The City of Fort St. John Zoning By-law Map (City of Fort St. John 2008)
- The District of Hudson's Hope Zoning Bylaw and Maps (District of Hudson's Hope 2009)

Relevant information related to agricultural economic activity, and to food production and consumption, was obtained from the following sources:

- Agricultural Land Commission
- Alberta Agriculture and Rural Development
- B.C. Ministry of Agriculture (B.C. Ministry of Agriculture and Food; B.C. Ministry of Agriculture and Lands)
- B.C. Ministry of Health
- BC Stats
- Canadian Grain Commission
- Farm Credit Corporation
- Saskatchewan Agriculture
- Statistics Canada
- U.S. Department of Agriculture Foreign Agriculture Service
- WorkBC

20.2.2 Land Capability for Agriculture

20.2.2.1 Land Capability Method

20.2.2.1.1 Land Capability Definition and Classification

Land capability for agriculture is derived from both soil and climate conditions, and refers to the potential for agricultural crop production. Capability is rated as Class 1 through 7. A description of each Class is provided below:

- Class 1 land is capable of producing the widest range of crops. Soil and climate conditions are optimum, resulting in easy management.

- Class 2 land is capable of producing a wide range of crops. Minor restrictions of soil or climate may reduce capability, but pose no major difficulties in management.
- Class 3 land is capable of producing a fairly wide range of crops under good management practices. Soil and climate limitations are somewhat restrictive.
- Class 4 land is capable of producing a restricted range of crops. Soil and climate conditions require special management considerations.
- Class 5 land is capable of producing cultivated perennial forage crops and specially adapted crops. Soil and climate conditions severely limit capability.
- Class 6 land is important in its natural state as grazing land. These lands cannot be cultivated due to soil and climate limitations.
- Class 7 land has no capability for soil-bound agriculture

Agricultural land can be assigned both unimproved and improved ratings. Unimproved ratings apply to the natural state of the land, whereas improved ratings apply to the land once improvements, such as irrigation and drainage, have been made.

20.2.2.1.2 Mapping Update

The existing maps covering the proposed reservoir area consisted of a series of draft 1:10,000 scale digital maps based on LiDAR and air photograph base imagery. GIS "layers" were also included, which showed slope classes, polygons (map areas) showing preliminary land capability for agriculture ratings in the reservoir from previous studies, Agricultural Land Reserve boundaries, Crown land, lands owned and leased by BC Hydro, and private lands.

These maps and other existing land capability information for the Project activity zone were reviewed, and in general were found to be out of date, or were not verifiable with current mapping, soil, and climate documentation. It was concluded that the land capability for agriculture needed to be updated in order to have accurate mapping, with supporting documentation and analysis for use in the assessment.

The update was based on the following:

- A mapping update, including a review of recent air photographs, detailed topographic mapping (derived from LiDAR)
- A field program to verify and refine soil capability
- Review and analysis of climate data
- Consideration of possible future changes to climatic ratings based on regional climate change scenarios

Based on this updated information, the preliminary land capability for the proposed reservoir area was revised as appropriate.

The land capability for agriculture mapping in non-reservoir areas of the Project activity zone and for other lands within the Peace River valley between the Peace Canyon Dam and the Alberta border was also reviewed. For these areas, recent air photography, topographic mapping, and existing 1:50,000 scale soil and land capability mapping were reviewed, and capability polygon boundaries were adjusted as appropriate. The results

of the soils field program and climate data review, as described below, were also taken into account.

The refined capability polygons, and the results of the soils field evaluation program and climatic capability analysis discussed below, were combined to create updated land capability maps for the Peace River valley between the Peace Canyon Dam and the Alberta border. This updated mapping is shown in Figure 20.2, Maps 1 through 25.

20.2.2.1.3 Soils Field Program

As indicated above, a soils field program was conducted for agricultural lands within the Project activity zone for the purpose of deriving updated agricultural land capability ratings.

The field evaluation was carried out for agriculturally capable areas within the Project activity zone where permanent or temporary loss of land may occur, including the reservoir, dam site, Highway 29 realignments, construction access roads, the transmission line, and quarried and excavated construction material source areas.

The program included field observations and data collection to determine soil characteristics required to classify soils according to the Land Capability Classification for Agriculture in British Columbia (Kenk and Cotic 1983). The key soil characteristics required to determine land capability for agriculture in the Project activity zone are as follows:

- Topography
- Soil texture
- Surface stoniness
- Depth to bedrock

Topography was determined using available topographic mapping and agricultural capability slope class mapping derived from LiDAR imagery. Field investigations determined and recorded micro-topography and evidence of erosion.

Soil texture, to determine proportions of sand, silt, and clay, was estimated in the field by hand, and coarse fragment content (the percentage of gravel, cobbles, and stones) was determined based on visual inspection. Samples were collected and analyzed for particle size in the laboratory to confirm field estimates. Soil texture provided the basis for available water storage capacity estimates and a general indication of soil fertility.

Additional soil characteristics that were noted during the field program, which influence capability, are listed below:

- Internal soil drainage
- Risk of flooding
- Impervious horizons
- Calcareous surface horizons

Key observations of the soils field program were that soils generally had a higher water holding capacity than was estimated in previous capability assessments. This higher soil

water holding capacity results in a greater extent of Class 1 soils than was previously estimated. These findings are incorporated into the capability assessment.

The agricultural soils field program and classification of land capability is described in more detail in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.2.2.1.4 Review and Analysis of Climate Data: Climatic Capability for Agriculture Ratings

Climatic capability for agriculture is another input into land capability ratings and, as described above, climate data was also reviewed and analyzed to derive the updated land capability ratings for the Project activity zone.

Climatic capability for agriculture is based on thermal parameters defined as growing degree-days and frost-free periods, derived from long-term (generally 30 years) average climatological values. Climatic capability is also based on a moisture parameter defined as climatic moisture deficit, or surplus. These parameters are discussed below.

The most recent regional climatic capability for agriculture mapping for the general area was published in 1983 (Ministry of Environment 1983). These climatic ratings were based on the 30-year period of 1951 through 1980. To assess if there have been changes in climate that would warrant updating climatic capability for agriculture mapping, data collected at the North Peace Regional airport for the 1951 through 1980 period was compared to the data collected during the 1971 through 2000 period. The Canada Atmospheric Environment Station at the North Peace Regional airport was the only climate station with the length of record that permitted this comparison.

Thermal parameters compared for the two 30-year periods were as follows:

- The frost-free period, defined as the period between the last spring average frost date and the average first fall frost date
- Growing degree-days, defined as the accumulated difference between the mean daily temperature and 5°C on days when the mean daily temperature is above 5°, starting on the first day of a consecutive five-day period when the mean daily temperature is equal to or greater than 5°C, and ending on the last day of the five-day period when the mean daily temperature is equal to or greater than 5°C

The results of the analysis of thermal parameters show that there has been an increase of approximately 65 growing degree-days, or approximately 0.5%, and an increase in the length of the frost-free period of 10 days. The last spring frost has occurred, on average, seven days earlier, and the first fall frost has occurred, on average, three days later. These changes were not large enough, relative to the accuracy of climatic capability polygon mapping, to justify amending the climatic capability for agriculture mapping.

Climatic moisture deficit was calculated for the period from May through September based on potential evapotranspiration minus precipitation. Estimates of long-term annual climatic moisture deficit at the North Peace Regional airport and at the BC Hydro climate stations ranged from 123 mm/year through 235 mm/year as shown in Figure 20.3. The median of the climatic moisture deficit values was 148 mm/year. This is consistent with the 1983 climatic capability mapping.

For lands inside the Project activity zone, the existing land capability for agriculture mapping assumed a climatic moisture deficit that was not large enough to influence land

capability for agriculture ratings. This previous capability mapping therefore showed no improvement in capability with irrigation. Compared to this previous land capability mapping, current analysis revealed an increased climatic moisture deficit that results in a reduced capability for unimproved conditions. Improved ratings are not influenced, as improved ratings assume that irrigation would compensate for the moisture deficit.

For lands outside the Project activity zone, the unimproved ratings reflect published agricultural capability mapping from the 1970s (Canada Land Inventory 1973) that were based on an assumed low climatic moisture deficit of 34 mm. However, the climate analysis conducted as part of this assessment estimated higher climatic moisture deficits. The higher climatic moisture deficits would result in reduced unimproved ratings in some locations. As discussed in Section 20.2.2.1, the soils field program revealed that soils within the Project activity zone generally had higher soil water holding capacities than previously estimated. Assuming that soils outside the Project activity zone also have higher soil water holding capacities than previously estimated, it is reasonably expected that the higher water holding capacity would partially offset the higher climatic moisture deficit when evaluating unimproved ratings. Therefore, the use of the unimproved ratings is reasonably considered to be representative of land capability for agriculture for areas outside the Project activity zone.

A detailed description of the method of determining climatic capability for agriculture is contained in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.2.2.1.5 Regional Climate Change

The impact of potential global climate change on future climatic capability for agriculture was assessed using temperature and precipitation anomalies for the 2050s and 2080s as calculated by the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria (see Volume 2 Appendix T Climate Change Summary Report) for B1 and A2 emission scenarios. The Intergovernmental Panel on Climate Change (IPCC) B1 emission scenario assumes that greenhouse gas emissions will eventually decrease, while the IPCC A2 emission scenario assumes emissions continuously increase (Volume 2 Appendix T Climate Change Summary Report).

The PCIC model predicts warmer conditions in 2050 and 2080 in all seasons of the years for each emission scenario, and similarly wetter conditions except during the summer months for the A2 scenario.

Growing degree days and frost-free period were calculated for each of the BC Hydro climate station locations by applying the monthly temperature anomoly data as a linear correction.

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 will improve, increasing the land capability for agriculture throughout the region. It is expected that the proportion of high capability land within the Project activity zone

relative to the total within the region will not increase with climate change, and may decrease.

20.2.2.2 Land Capability: Baseline Description

The updated land capability for agriculture mapping is shown in Figure 20.2, Maps 1 through 25.

To provide context, Table 20.4 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 20.4 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

NOTE:

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

20.2.3 Agricultural Suitability of Lands

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 developed and a methodology similar to that described in the Soil Management Handbook for the Okanagan and Similkameen valleys (Gough et al. 1994). Agriculturally capable lands were rated as well suited, suited, or not suited for a variety of crops (Table 20.5).

Table 20.5 Suitability Rating of Agriculturally Capable Lands

Rating	Description
Well Suited	• Management inputs can be made by an individual producer • Technological inputs are low to moderate • Irrigation is provided if required
Suited	• Moderate to high level of expertise and management • Technological inputs are moderate to high (e.g., drainage, organic matter additions) • Economic inputs may be high (e.g., land levelling) • Risk of crop failure may be moderate to high • Irrigation is provided if required
Not Suited	• Risk of crop failure is high

For areas within and near the reservoir, soil characteristics generally do not limit the suitability of most crops, and crop suitability is primarily dependent on climate.

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 20.6. This table provides examples of crops that would be well suited or suited, but is not an exhaustive list of all potential crops that would be well suited or suited. Table 20.6 also provides an indication of the range of crops that can be grown in areas of different land capability classes. A determination of the range of crops that could be grown successfully at a specific location would require a site-specific evaluation of soils and climate.

Table 20.6 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

20.2.4 Agricultural Utility

20.2.4.1 Agricultural Utility: Method

Areas within the Project activity zone were assigned an agricultural utility rating to reflect the likelihood of future agricultural use. In accordance with the EIS Guidelines, 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 following factors were considered in assigning an agricultural utility rating:

- Land capability for agriculture
- Land use plans and potential protected areas
- Tenure
- Location and access
- Parcel size and configuration
- Environmental constraints such as wildlife habitat

Areas with improved capability ratings of Class 1 through 3 were initially assigned a high utility, Class 4 and 5 were assigned a moderate utility, and other areas were assigned a low to nil utility. Initial utility ratings were then adjusted to reflect the potential constraints to the land being used for cultivated agricultural production in the future, in absence of the Project, as described below.

The Province completed land use plans for Fort St. John and Dawson Creek areas through the Fort St. John and Dawson Creek Land and Resource Management Plans (B.C. Ministry of Forests, Lands and Natural Resource Operations 1997, 1999). Both plans recommended the creation of the Peace River Boudreau Lake Protected Area. If created, this protected area would include land within the Project activity zone, including the majority of the south bank lands and islands that are within the proposed reservoir area. If the protected area is established, agricultural land use would be expected to be limited to existing grazing tenures or some expanded grazing use. It is unlikely that any cultivated agriculture would occur within the protected area. For these reasons, lands within the proposed protected area were assigned a low to nil utility rating.

Without the protected area designation, agricultural utility of portions of the proposed protected area would be limited by access, particularly land on the islands. Agricultural land use within the remainder of the Project activity zone is generally not restricted by existing zoning, nor is it expected to be restricted by the implementation of recommendations in the two Land and Resource Management Plans.

Apart from the recommendations of the Land and Resource Management Plans, likely future agricultural use was assumed not to be restricted by tenure. Therefore, the agricultural utility ratings were not considered to be constrained by ownership, or by status as Crown, private, or ALR.

Agricultural utility also considered location, access, parcel size, parcel configuration, and potential environmental constraints. Areas with no existing access and for which creating access would be difficult and expensive, as well as areas that are relatively small and isolated were assigned a low to nil utility rating. Examples would be parcels along the tributaries that are contained by steep banks.

Agricultural utility ratings outside of the recommended protected area were not reduced to address potential environmental constraints, such as competing land uses (e.g., wildlife habitat), though environmental issues may constrain agricultural development in some areas.

20.2.4.2 Agricultural Utility: Baseline Description

The agricultural utility ratings assigned to areas with agricultural capability within the Project activity zone are shown in Figure 20.4, Maps 1 through 16.

To provide a comparison of agricultural utility within the Project activity zone to utility in remaining areas of the Peace River valley, a utility rating was also assigned to areas within the Peace River valley but outside the Project activity zone. Islands and tributaries were assigned a low to nil rating on the basis of limited access.

Utility outside the Project activity zone was defined as follows:

- Upstream of the dam site:
  - High utility includes Class 1 through 3 land on the north bank, excluding tributaries
  - Moderate utility includes Class 4 and 5 land on the north bank, excluding tributaries
- Downstream of the dam site:
  - High utility includes Class 1 through 3 land on the north and south banks, excluding islands and tributaries
  - Moderate utility includes Class 4 and 5 land on the north and south banks, excluding islands and tributaries

20.2.5 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.

20.2.6 Agricultural Tenures on Crown Land

Information on agricultural tenures on Crown lands within the Project activity zone, including associated management plans and livestock carrying capacity, available from the B.C. Ministry of Forests, Lands and Natural Resource Operations, was collected from their Dawson Creek office, mapped, and summarized.

The B.C. Ministry of Forests, Lands and Natural Resource Operations indicated that carrying capacity in the area ranges from 3.2 through 6.1 ha per animal unit month (AUM). Information in range use plans for licences that would be affected were provided by the B.C. Ministry of Forests, Lands and Natural Resource Operations, and showed carrying capacities ranging from 2.3 through 20.7 ha per AUM.

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.

20.2.7 Agricultural Operations

As stated in the EIS Guidelines, current and expected future agricultural operations and practices were determined through interviews with owners and operators of potentially affected agricultural operations, as well as through review of agricultural census information for the agricultural land LAA.

20.2.7.1 Interviews

Interviews were conducted in 2011 and 2012 with the owners and operators of agricultural operations located in the agricultural land LAA. These interviews were focused on the collection of information related to current and future agricultural activities and information required to define and evaluate on-farm effects. Additional information on the interview process is contained in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

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 input acquisition channels
- Short-term and long-term concerns related to potential effects of the Project on agricultural operations
- Avoidance and mitigation options
- Regional compensation and enhancement opportunities

All producers with a portion of their operation within the Project activity zone were sought for interview.

Table 20.7 lists 34 farm operations where a portion of the operation is within the Project activity zone.

Table 20.7 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

20.2.7.2 Statistics Canada Data

The following sections describe local and regional agricultural land use and agricultural sector characteristics.

20.2.7.2.1 Land Use

The Peace Agricultural Region is represented by Peace River Census Division 55 and the Northern Rockies Census Division 59. Census Division 55 and Census Division 59

correspond to the Peace River Regional District and the Northern Rockies Regional Municipality, respectively. The area of farms in Census Division 55 represented 99.03% of the total area of farms in the Peace Agricultural Region in 2011.

The Peace Agricultural Region comprises about 22% of B.C.'s land area and contains 32% of the province's ALR land or 1,522,145 ha (Agricultural Land Commission 2010). About 7.4% of the Peace Agricultural Region is in the ALR. Farms in the Peace Agricultural Region comprise 32% (831,566 ha) of the total land on Census farms in B.C. (2,611,383 ha), according to the 2011 Census of Agriculture (Statistics Canada 2012a).

The following is a breakdown of the use of land on Census farms in the B.C. Peace Agricultural Region (Statistics Canada 2012a):

- 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%

Peace Agricultural Region farms comprise 8% of the farms in the province. Overall, the number of farms decreased 12% in the Peace Agricultural Region between 2001 and 2011, compared to a decline of about 3% in B.C. as a whole. The average farm size in the Peace Agricultural Region is 533 ha, which is four times larger than the provincial average of 132 ha.

The proportion of cultivated land in crop, tame, and seeded pasture and summer fallow in the Peace Agricultural Region is 46% of the total area on Census farms in the province. The total cultivated area has declined in both the Peace Agricultural Region and the province since 2001 (Statistics Canada 2012a, 2012b).

20.2.7.2.2 Agricultural Sector Characteristics

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 response to increased run-ups in global market prices.

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 (Statistics Canada 2012a).

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.

From 2001 to 2011, animal inventories of meat chickens, hogs, and bison increased in the Peace Agricultural Region, while all other livestock categories declined. A summary of the main livestock sectors is provided below (Statistics Canada 2012a, 2012b):

- Beef cows: The Peace Agricultural Region contained 51,506 head of cows and replacement heifers in 2011, representing 23% of the population in the province. From 2001 to 2011, the population declined by 30% in the region. Many farmers have left the sector or substantially downsized herds due to declines in the market.
- Bison: About 84% of B.C.'s farmed bison, numbering 7,765 head in 2011, are raised in the Peace Agricultural Region. Low prices resulted in a drop in herd numbers between 2001 and 2006, followed by modest recovery in 2011 and an overall increase of 14%.
- Other livestock: Other livestock categories in the Peace Agricultural Region include sheep (ewes) at 17% of the livestock inventory, hogs (sows and gilts) at 8%, and goats at 7%. With the exception of the hog category, which has increased by 14%, all other livestock categories have declined in the Peace Agricultural Region over the last decade.
- Honeybees: In 2011, Peace Agricultural Region honey hives represented 5% of the provincial total. The number of hives dropped 59% in the Peace Agricultural Region since 2001, but has increased across the province by 17%. Honey production in the Peace Agricultural Region is largely a byproduct of extensive crop pollination operations.
- Horses: In 2011, horses in the Peace Agricultural Region represented 18% of the total number in the province. Since 2001, the equine population decreased 17% in the Peace Agricultural Region and 14% provincially.
- Poultry and dairy: The dairy and poultry sector livestock inventory is less than 1% of the provincial total. While the sectors are very small, poultry inventory showed growth of 130% during the 2001 to 2011 period; however, the dairy presence in the Peace Agricultural Region declined by 48%.

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%).

The following is an overview of the dominant crops in the Peace Agricultural Region (Statistics Canada 2012a, 2012b):

- Forages: Alfalfa and alfalfa mixtures (35%) and other tame hay and fodder crops (17%) dominated the land reported in crops in 2011. In B.C. as a whole, these types of crops represent 64% of the cropped area. Between 2001 and 2011, the area of

alfalfa production increased 23% in the Peace Agricultural Region, while the area of other tame hay decreased 35%. The total area in hay and fodder production decreased 3.5%.

- Grains and oilseeds: Canola (12%), wheat (11%), oats (11%), and barley (6%) represented 40.5% of the cropped area in the Peace Agricultural Region in 2011. In B.C. as a whole, these types of crops represented only 22% of the cropped area. Among these major field crops, between 2001 and 2011, the canola area increased 49%, the wheat and oats area rose 16% and 20%, and the barley area dropped 25%.
- Forage seeds: Forage seed production area, represented predominantly by creeping red fescue seed, but also by some alfalfa seed, comprised about 5.5% of the land in crops in the Peace Agricultural Region in 2011. Forage seed crops have declined in area greatly over the last decade.
- Dry field peas: Dry field peas are a relatively new cash crop in the Peace Agricultural Region and accounted for 1.4% of the land in crops in 2011. Field peas are sold into export and regional feed markets. The area planted increased by 32% between 2001 and 2011.

In 2011, 22 farm operators produced organic products in the Peace Agricultural Region. The main organic products are hay crops and organic animals or animal products (Statistics Canada 2012a).

20.2.8 Agricultural Economies

20.2.8.1 Marketing

Consolidation in the input supply sector of the agricultural industry has intensified over the last few decades. The grains and oilseeds sector of the Peace Agricultural Region is now largely served by suppliers such as Viterra, Agro Source Ltd., and Cargill in Dawson Creek and Fort St. John. There are also two farmer-owned seed cleaning plants in the Peace Agricultural Region.

The main granular urea and ammonia fertilizer storage and distribution facility in the region is Canadian Fertilizers Ltd., which has a terminal and fertilizer plant in Alberta.

Cash grain sales are marketed to a number of regional grain dealers, primarily for export to Asian markets. Some feed grains are sold directly to feed lots and livestock yards out of province.

Forage seeds are marketed to dealers in B.C. and Alberta. The bulk of common forage seed makes its way to the U.S. export market, with about 10% sold inter provincially.

Farmers also tend to produce a slight surplus of hay in case of weather-related yield declines. This often leads to the sale of surplus hay into local and regional markets.

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. Small local butcher facilities slaughter local livestock and process meat for the local market. While some retailers may buy some produce in the Peace Agricultural Region, the large retail chains buy wholesale through centralized distribution centres across Canada and the U.S. (USDA Foreign Agriculture Service 2012).

A few farmers' markets selling local honey, fruits, and vegetables are in operation in the region, and some vendors also sell processed food products such as baking and preserves.

Livestock sales occur regionally at auction, at points in Alberta, and through Internet bidding. Livestock such as bison, deer, hogs, and sheep raised in the Peace Agricultural Region tend to be butchered locally and packed or processed into livestock products that are sold locally or exported regionally.

Meat sales in the region are dominated by the large retail food chains, which procure from major suppliers outside of the Peace Agricultural Region. The Peace Agricultural Region is also served by several provincially licensed abattoirs in the area (BCMOH 2012). With changes to B.C.'s *Food Safety Act*, more stringent meat processing regulations have limited slaughter and processing of meats for sale to provincially and federally licensed abattoirs, and have required pre-existing processing facilities to meet new provincial standards. In 2010, amendments to B.C.'s Meat Inspection Regulation were made to allow Class D and Class E licences that now permit limited on-farm slaughter for producers who cannot access a licensed facility to meet their slaughter needs. However, financial costs are often beyond the reach of small-scale processors.

20.2.8.2 Agricultural Population and Employment

In 2011 agriculture in the Peace Agricultural Region comprised 1,560 farms operated by 2,325 farm operators (Statistics Canada 2012a). About 65% of farms had two or more farm operators, often family members.

Two Hutterite colonies own and farm large tracts of land in the Peace Agricultural Region near Farmington (approximately 25 km north of Dawson Creek), and a German Mennonite settlement at Prespatou (approximately 80 km north of Fort St. John) continues to farm in the area.

Agriculture employed about 3% of the region's workforce (WorkBC No date), or about 1,200 person-years, in 2010. Only about 20% of the farms pay formal wages and salaries. In 2010, agricultural operators paid about $8.596 million in total agriculture-related wages and salaries (the 2011 Census of Agriculture asked farmers to respond to questions about wages and salaries based on the 2010 or the last complete fiscal period, as appropriate). Of the farms using paid labour, 73% utilize seasonal or temporary labour and 46% employ farm workers full-time. The total weeks of annual paid employment represent about 312 person-years of employment, based on an estimate of 49 weeks of employment per year per full-time worker. The number of farms using paid labour and the number of weeks of employment have dropped 28% and 30%, respectively, since 2005.

About 57% (894 farms) of Peace Agricultural Region farms were sole proprietorships, 30% (470) were formal or informal partnerships, and 10% (162 farms) were family corporations in 2011.

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.

20.2.8.3 Economic Returns from Farming

Key measures of economic returns from farming include the following:

- Gross farm receipts: In 2010, Peace Agricultural Region farmers generated about $145 million, or 4.9% of the gross farm receipts generated in B.C. Total gross farm receipts have increased slightly more rapidly in B.C. as a whole than in the Peace Agricultural Region over the last decade.
- Contribution margin (gross farm receipts less operating expenses as reported in the Census): In 2010, the average contribution margin across all farm types in the Peace Agricultural Region was 5.4%.
- Total farm capital: Total farm capital value increased 64% in the Peace Agricultural Region, compared to an increase of 119% in B.C. as a whole.
- Livestock and poultry: Between 2001 and 2011, livestock and poultry inventory value declined by 51% in the Peace Agricultural Region, compared to a decrease of 41% in the province.
- Land and Buildings: About 83% of the farm capital of Peace Agricultural Region farm operations is composed of land and building value, compared to 93% in B.C. as a whole. Between 2001 and 2011, land and building value increased farm capital value by more than 100% in the Peace Agricultural Region and by almost 150% in B.C. (Statistics Canada 2012a, 2012b).

Characteristics of farms in the Peace Agricultural Region include the following:

- Gross receipts: In 2010, over half (56%) of farming operations in the Peace Agricultural Region grossed less than $25,000 and only about 18% grossed more than $100,000 annually.
- Farm size: In 2011, approximately 31% of the Census farms were a quarter section (160 acres or 65 ha) or less.
- Area in crops or summer fallow: In 2011, 23% of farms had less than 60 acres (26 ha) in crops or summer fallow.

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).

Additional information on the regional agricultural economy is contained in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.2.9 Food Production and Consumption

Food production and consumption in B.C. and the Peace Agricultural Region are outlined in the following sections.

20.2.9.1 Historical Food Self-Reliance in British Columbia

With globalization and increased trade, B.C. and Canada have substantially increased their levels of both food exports and imports. This shift to sourcing increased levels of food from outside the province and the country reflects the federal government's food

security strategy (Government of Canada 1998). This strategy is a global commitment that includes enhancing trade in the food and agri-food sectors as a way of reducing vulnerability to food shortages. 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., as elsewhere in the country, this shift has led to decreasing levels of food self-reliance. Table 20.8 shows that B.C.'s overall food self-reliance has decreased from the close to 100% self-reliance noted in 1946 to levels close to 50% today.

Table 20.8 British Columbia's Historical Reliance on Food Imports

Period	Import Contribution to Food Consumption (%)	Self-Reliance (%)
1946[a]	3	97
1955[a]	29	71
1970s[b]	44–49	51–56
1970s[a]	60	40
1982[c]	53	47
1980s[d]	27–31	69–73
1990s[e]	40	60
2000s[f]	52	48

NOTES:
[a] Furuseth and Pierce (1982)
[b] Markham (1982)
[c] Warnock (1982) as cited in BCMAL (2006)
[d] Reimann (1987) as cited in BCMAL (2006)
[e] Provincial Health Services Authority (2010)
[f] BCMAL (2006)

20.2.9.2 Food Self-Reliance in the Peace Agricultural Region

The total per capita availability of food in Canada in 2010 is estimated at 580 kg/year (Statistics Canada 2010), not including alcoholic beverages. Approximately 52% of food consumption is of fruits and vegetables. Cereal products are also substantial, at 13% of total consumption.

As outlined earlier, food self-reliance is a comparison of total production (regardless of whether it is consumed in the area being considered or exported) and consumption.

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

- In grains (cereals), the region is in surplus self-reliance, exceeding 100% by a multiple of six. In oils and fats, the region is in surplus self-reliance, exceeding 100% by a multiple of four.
- In sugars, there is surplus self-reliance exceeding 100%
- In vegetables, the region has low self-reliance for crops that are climatically adapted to the region, producing 5% of the regional consumption of these crops

- In fruits and berries, the region has moderate self-reliance for crops that are climatically adapted to the region, producing 45% of the regional consumption of these crops
- In dairy and poultry, the region has low self-reliance, about 5%, mostly because it is not currently economically feasible to base these enterprises in the region
- In red meats, the region has high self-reliance, somewhere between 50% and 100%, but could be substantially higher if animals were finished in the region. Estimates are that 90% of the calves are currently exported to Alberta for finishing.
- In fish, the region has nil self-reliance, since fish are not harvested commercially in the Peace Agricultural Region

Overall, regional food self-reliance has not been examined in detail. Nonetheless, it is estimated that about 30% of the fresh-equivalent weight of vegetables consumed cannot be grown in the region. For fruits and berries, slightly over 96% of the products consumed cannot be grown in the Peace Agricultural Region. At a maximum, this means that the Peace Agricultural Region is capable of producing 41% of the total fruits and vegetables consumed.

Additional information on food self-reliance is contained in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.3 Effects Assessment

This section considers the effects of the Project on agriculture in relation to the changes to the following four key aspects:

- Agricultural land
- Farm operations
- Agricultural economies
- Food production and consumption

For each aspect, the effects assessment discusses the effects of Project construction and operation and applicable mitigation measures. Residual effects are evaluated in Section 20.5.

The evaluation of changes to the agricultural land base included an estimation of the loss of land with potential agricultural value, an evaluation of the percentage of that land loss within a local, regional, and provincial context, and an evaluation of the potential effects of reservoir-induced changes to local microclimate on the agricultural land base.

The evaluation of changes to farm operations considered the loss of land and agricultural production and access, farm infrastructure, livestock management, water management, the introduction and proliferation of invasive plant species, biosecurity risks, and farm worker safety.

The evaluation of changes to agricultural economies included an estimation of the potential changes to primary and secondary economic activity within the agricultural economy LAA.

The evaluation of potential changes to regional food production and consumption considered changes in food production capacity in relation to regional food consumption.

20.3.1 Effects Assessment – Construction – Agricultural Land Base

This section summarizes effects on the agricultural land base that would occur during construction. As discussed above in Section 20.1.2, these effects would occur through the following project activities:

- Site clearing and preparation
- Dam, generating station, and spillway construction activities
- Reservoir preparation and filling
- Transmission line construction
- Highway 29 realignment
- Construction access road development
- Quarried and excavated material source development
- Worker accommodation construction

The effects of each of these activities are discussed below.

20.3.1.1 Primary Construction Activities

Land clearing and access road construction associated with reservoir preparation will disturb some agricultural lands.

Where individual farms may be affected, road locations will be discussed with farm operators and where appropriate agreements will be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.1.2 Dam, Generating Station, and Spillways

Construction activities within the dam site would result in both temporary and permanent loss of agricultural land. Permanent losses would result from permanent roads (Old Fort Road realignment, 269 Road extension, south bank Project access road, Septimus Siding) and permanent offices and warehouses, as shown in Figure 20.6 in Map 6. These losses are summarized in Table 20.9 by capability class. Areas of improved land capability for agriculture ratings are shown in brackets. The areas exclude locations within the reservoir full supply level, which are presented in the summary in Section 20.3.1.3, but include other project components such as construction access roads, material source sites, and worker accommodation area within the dam site.

Table 20.9 Loss of Agricultural Land – Dam Site (ha)

Type of Land Loss	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6 & 7	Total
Temporary	24 (33)	285 (290)	77 (63)	7 (7)	77 (77)	37 (37)	506 (507)
Permanent	0 (14)	75 (61)	29 (29)	0 (0)	0 (0)	61 (61)	165 (165)

NOTES:
Unimproved capability and, in brackets, improved capability

All temporary construction areas, including laydown areas, worker accommodation areas, conveyor, and temporary access roads, will be reclaimed in accordance with the Project Soil Management, Site Restoration and Revegetation Plans as described in Volume 5 Section 35 Summary of Environmental Management Plans. Areas of current or potential agricultural use will be reclaimed to pre-disturbance capability or better.

20.3.1.3 Reservoir

All of the agricultural land within the full supply level of the reservoir would be permanently lost. Permanent loss of agricultural land due to inundation would occur during the reservoir filling stage of construction. Islands that would be created during reservoir filling have ~~not~~ been included in the estimates of land that would be permanently lost.

Estimated areas of permanent losses are summarized in Table 20.10, based on both improved and unimproved capability ratings (improved capability ratings are shown in brackets). The reservoir area includes current land and river channel areas. The reservoir surface area of 9,330 ha would comprise 4,523 ha of current land area and 4,807 ha of current river channel and recent alluvium.

Table 20.10 Land Within the Reservoir (ha), by Capability

Geographic Area	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6 & 7	Total Area
Current Land							
Peace – North Bank	0 (525)	697 (291)	137 (20)	45 (43)	43 (43)	567 (567)	1,489 (1,489)
Peace – South Bank	0 (379)	432 (106)	160 (107)	16 (16)	6 (6)	483 (483)	1,097 (1097)
Peace – Islands	0 (373)	687 (471)	162 (68)	68 (5)	19 (19)	58 (58)	994 (994)
Tributaries 0	(135)	474 (432)	226 (133)	53 (53)	0 (0)	190 (190)	943 (943)
Current Land Subtotal	0 (1412)	2,290 (1,300)	685 (328)	182 (117)	68 (68)	1,298 (1,298)	4,523 (4523)
Current River channel and recent alluvium	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**4,807**
Total Reservoir Area	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**9,330**

NOTES:
N/A – not applicable
Unimproved capability and, in brackets, improved capability

Two historical assessments of land capability within the reservoir area were previously completed (CBRC 1979; Pottinger 1982a, 1982b). A description of each of these historical assessments is provided in Volume 3 Appendix D Agricultural Assessment Supporting Documentation. The results of these historical assessments are summarized in Table 20.11 and compared to the most recent updated capability summaries.

Due to differences in delineating capability polygons and in classifying Class 5, 6, and 7 lands between the studies, it was only possible to compare Class 1 to 4 lands.

Table 20.11 Comparison of Land Capability for Agriculture Within the Proposed Site C Reservoir: Historical and Current Studies (ha)

Capability Assessment	Class 1	Class 2	Class 3	Subtotal	Class 4	Total
Historical, unimproved[a]	100	2,300	520	2,920	240	3,160
Historical, unimproved[b]	106	2,215	607	2,928	162	3,090
Golder, unimproved – 2012	0	2,290	685	2,975	182	3,157
Golder, improved – 2012	(1,412)	(1,300)	(328)	(3,040)	(117)	(3,157)

NOTES:
[a] CBRBC 1979
[b] Pottinger 1982a

The different assessments yielded similar results, particularly when the previous results were compared with the current unimproved ratings. The differences between the current assessment's unimproved and improved ratings are discussed in the agricultural land base baseline section (Section 20.2.2). The current assessment indicates that, with irrigation to achieve the improved ratings, the Class 1 area is greater than previously estimated, based on the improved soil quality revealed during the soils field program. All of the estimates indicated similar amounts of Class 1 through 3 lands.

20.3.1.4 Transmission Line to Peace Canyon

The upgraded transmission line would be approximately 77 km long, running from the switchyard at the proposed Site C Dam to the substation at the Peace Canyon Dam, as shown in Figure 20.6 Maps 6 through 10. The transmission line would pass through approximately 38 km of areas with agricultural activities, including one private agricultural operation (7 km), one grazing lease (10 km), and four grazing licences (21 km).

Within the transmission line corridor, land capability for agriculture is mostly Class 3 through 5, with some Class 7 lands.

Land disturbance associated with construction of the upgraded transmission line would include disturbances due to clearing, access road construction, tower foundation construction, tower erection, and conductor stringing.

The only areas where there would be permanent loss of agricultural land would be at the tower foundations. New access roads, tower construction pads, and temporary laydown and staging areas would be restored and revegetated once construction of the transmission line is completed, and therefore will not result in permanent loss of agricultural land.

It is expected that land clearing and ongoing vegetation management within the widened transmission right-of-way and the revegetation of disturbed areas would increase forage production to an extent that this increased forage production would compensate for the permanently lost land.

20.3.1.5 Highway 29 Realignment

Highway 29 realignment locations, shown in Figure 20.6 Maps 1 through 4, include:

- Cache Creek

- Halfway River
- Farrell Creek East
- Farrell Creek
- Dry Creek
- Lynx Creek

The highway realignments would potentially affect agricultural lands, some of which are currently cultivated or used for pasture.

Estimated losses of agricultural land associated with the highway realignments include lands within proposed new right-of-way or, where a new right-of-way has not yet been defined, an area equal to the land within the currently defined highway corridor. Proposed new rights-of-way have been defined for the Farrell Creek, Halfway River, and Lynx Creek realignments and for a portion of the Cache Creek realignment. For those locations where only a corridor has been defined, including Dry Creek and a portion of the Cache Creek realignment, it has been assumed that the new right-of-way would occupy the entire width of the corridor. This provides a conservative estimate of permanent loss of land, as the area within the highway right-of-way alignment will be less than that within the corridor.

Highway realignment construction would also result in temporary disturbances in areas outside of the new right-of-way, such as for construction laydown, equipment staging, and detours. These temporarily disturbed areas will be reclaimed in accordance with the Project Soil Management, Site Reclamation, and Revegetation Plan as described in Volume 5 Section 35 Summary of Environmental Management Plans. Abandoned sections of the highway located outside of the reservoir would either be converted to local access roads or decommissioned and restored to natural conditions.

Estimated areas of land loss resulting from Highway 29 realignments are summarized in Table 20.12. Improved capability ratings are shown in brackets. An estimated 330 ha would be permanently lost due to Highway 29 realignments. Of this total, 149 ha have an unimproved capability of Class 2 and 32 ha an unimproved capability of Class 3.

Table 20.12 Loss of Agricultural Land by Capability – Highway 29 Realignment (ha)

Type of Land Loss	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6&7	Total
Temporary	0 (26)	47 (30)	10 (8)	20 (13)	0 (0)	32 (32)	109 (109)
Permanent	0 (121)	149 (54)	32 (57)	66 (15)	1 (1)	82 (82)	330 (330)

NOTE:
Unimproved capability and, in brackets, improved capability

20.3.1.6 Construction Access

Construction access outside of the dam site that would permanently affect agricultural land includes the south bank Project access. Permanent loss of agricultural land associated with the Old Fort Road realignment, the 269 Road extension, and the

Septimus siding are included in the dam site land loss estimates. The section of south bank Project access road where there would be a permanent loss of land is shown in Figure 20.6 Maps 1 through 10. This area totals 78 hectares, including 52 hectares of Class 3 lands and 7 hectares of Class 4 lands.

Upgrades of the existing Jackfish Lake Road will be discussed with B.C. Ministry of Transportation and may include widening; however, all works will be within the existing road right-of-way with no permanent loss of agricultural land.

All other construction roads, including clearing roads and the conveyor leading to the dam site area, would result in temporary loss of agricultural land as shown in Figure 20.6 Maps 1 through 10. Disturbed areas with agricultural potential will be reclaimed in accordance with the Project Soil Management, Site Reclamation, and Revegetation Plan as described in Volume 5 Section 35 Summary of Environmental Management Plans. The estimated area disturbed by construction access outside of the reservoir and dam site is summarized in Table 20.13. Areas of improved capability are shown in brackets.

Table 20.13 Loss of Agricultural Land by Capability – Construction Access (ha)

Type of Land Loss	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6&7	Total
Temporary	0 (1)	10 (9)	9 (9)	2 (2)	2 (2)	14 (14)	37 (37)
Permanent	0 (0)	0 (0)	52 (52)	7 (7)	19 (19)	0 (0)	78 (78)

NOTE:
Unimproved capability and, in brackets, improved capability

20.3.1.7 Quarried and Excavated Materials

Potential quarried and excavated materials sources that would affect agricultural lands are shown in Figure 20.6 Maps 1 through 9. Table 20.14 lists the potential sources and shows ALR status, Crown land agricultural tenure, capability for where there is potential agricultural use, and current cultivation.

Table 20.14 Off-site Materials Site Characteristics

Site	ALR	Tenure	Grazing Lease or Licence	Land Capability (Class)	Current Cultivation	Temporarily Disturbed Area (ha)
Wuthrich Quarry	Yes	Private	No	Class 3 & 4, partially disturbed	Partial	18
West Pine Quarry	No	Crown	No	n/a	No	104
Portage Mountain	No	Crown	No	n/a	No	148
Del Rio Pit	No	Crown	Yes	Class 5 & 7	No	162
85th Avenue Industrial Lands	No	Private	No	n/a	No	100
Area E	Yes	Private & Crown	Partial	Class 3, 6 & 7	No	80
Borrow Source 1	Partial	Crown	No	Class 3 & 5	No	27
Borrow Source 2	Yes	Private	No	Class 4, 6 & 7	No	17
Borrow Source 3	Yes	Private (BC Hydro)	No	Class 4	No	3

NOTE:
ALR – Agricultural Land Reserve

On-site material sources (Area A, Area C, and the Howe Pit) are within the dam site area, with disturbed areas associated with these sites included in the assessment of dam site disturbed areas (refer to Section 20.3.1.2).

Wuthrich Quarry and the Del Rio Pit are existing B.C. Ministry of Transportation and Infrastructure sources. These sites would be operated under the existing authorizations. These areas do not represent a loss of land due to the Project.

Off-site borrow Sources 1 through 3 are potential sources outside of the reservoir inundation area along Highway 29. The preference would be for use of material source areas within the reservoir inundation area. Material from the off-site areas would be used only if there was not enough material available from sites within the inundation area.

All new material source sites that are outside of the reservoir and within the ALR or an agricultural Crown land tenure will be reclaimed in accordance with the Project Soil Management, Site Reclamation, and Revegetation Plan as described in Volume 5 Section 35 Summary of Environmental Management Plans.

Activities at aggregate material sources will not result in permanent loss of agricultural land. Estimates of the temporary loss of land that would be associated with the material source sites are included in Table 20.15.

20.3.1.8 Worker Accommodation

One planned temporary worker accommodation location would be within the dam site. Land disturbances associated with this location are included the dam site disturbed areas (refer to Section 20.3.1.2).

Locations for other temporary worker accommodations have not been identified. Worker accommodations that would be located within ALR areas, or areas with agricultural capability of Class 4 or better, would be reclaimed in accordance with the Project Soil Management, Site Reclamation, and Revegetation Plan as described in Volume 5 Section 35 Summary of Environmental Management Plans.

20.3.2 Effects Assessment – Operations – Agricultural Land Base

Effects on the agricultural land base that would occur during operations include effects within reservoir impact lines, effects due to changes in groundwater elevations, and effects from transmission line maintenance and vegetation management.

20.3.2.1 Reservoir

Several preliminary impact lines have been defined to delineate areas beyond the full supply level of the reservoir that may be affected by the reservoir.

These impact lines are listed below:

- Erosion Impact Line
- Flood Impact Line
- Stability Impact Line
- Landslide-Generated Wave Impact Line

A detailed discussion of preliminary reservoir impact lines is provided in Volume 2 Appendix B Geology, Terrain Stability, and Soil Reports Part 2 Preliminary Reservoir Impact Lines.

Areas within the Flood, Erosion, and Stability Impact Lines are summarized in Table 20.15. Areas are reported using both current unimproved capability and improved capability in brackets. Areas noted for the Flood Impact Line are areas that are beyond the Erosion Impact Line, and areas noted for the Stability Impact Line are areas that are beyond the erosion and flood impact lines. Areas noted for the Landslide-Generated Wave Impact Line are areas which are beyond the Erosion, Flood and Stability Impact Lines.

Table 20.15 Land Within Impact Lines (ha), by Capability

Impact Line	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6 & 7	Total
Land predicted to be altered by erosion over 100 years (assessed as likely permanently lost to agricultural use)	0 (10)	87 (56)	34 (46)	25 (34)	15 (15)	1212 (1,212)	1,373 (1,373)
Flooda,[b]	0	111	40	0	13	39	203
Stabilitya,[b]	0	84	39	12	5	5,773	5,913
Landslide-generated wave[a]	0 (135)	148 (25)	12 (2)	2 (0)	5 (5)	7 (7)	174 (174)

NOTE:
[a] Areas outside the erosion area (not assessed as permanently lost to agricultural use)
[b] Capability ratings are based on previous Canada Land Inventory mapping and therefore only unimproved ratings are provided
Unimproved capability and, in brackets, improved capability

For this assessment, it was assumed that land within the Erosion Impact Line would be permanently lost to agricultural production over a period of 100 years of reservoir operation. Due to the lower probability for loss of land or effects within the other impact lines caused by the creation and operation of the reservoir, areas within these lines have

not been added to the total estimates of permanently lost land. Flooding within the Flood Impact Line may not result in loss of land, but may result in crop losses when flooding occurs.

The areas within the Erosion Impact Line have been included in the totals for permanently lost land that are summarized in Section 20.3.3.1.~~2.4.~~

20.3.2.2 Changes in Groundwater Elevations

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 agricultural land LAA 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.

Groundwater elevations in areas where agricultural lands may be affected will be evaluated to determine if potential productivity is altered.

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.

Further information on potential changes in groundwater elevations is contained in Volume 2 Section 11.6 Groundwater Regime.

20.3.2.3 Transmission Line

Maintenance and vegetation management within the transmission line right-of-way are not expected to have any effects on the agricultural land base. Vegetation management within the transmission right-of-way may have a positive effect in maintaining a higher level of forage production than currently exists within the existing right-of-way.

20.3.3 Summary and Comparison of Permanent Losses of Agricultural Lands

The following sections summarize the permanent loss of agricultural land that would occur with project operations. Losses for individual project components have been described above. Summaries are provided by capability class and compared to totals for the Peace River valley, the Peace Agricultural Region and the province to provide a relative measure of the loss. Land losses are also summarized by tenure, ALR status, and agricultural utility.

20.3.3.1 Permanent Land Loss by Capability

Table 20.16 and Table 20.17 summarize the permanent loss of agricultural land, by capability, which would occur as a result of the Project. These tables summarize unimproved capability and include losses during both construction and operations. The majority of the permanent loss of land would occur during construction. The only permanent loss resulting from Project operations is the loss of land within the Erosion impact line.

Table 20.16 summarizes the permanent loss of land by project component:

- 4,523 ha (70%) of the total 6,469 ha of permanently lost within the Project activity zone would be within the reservoir
- 3,225 ha (85%) of the Class 1 to 5 land would be within the reservoir

Table 20.16 Permanently Lost Agricultural Land (ha) Within the Project Activity Zone, by Unimproved Capability

Project Component or Activity	Class 1	Class 2	Class 3	Class 4	Class 5	Subtotal Class 1–5	Subtotal Class 6& 7	Total
Reservoir 0		2,290	685	182	68	3,225	1,298	4,523
Highway	0	149	32	66	1	248	82	330
Erosion	0	87	34	25	15	161	1,212	1,373
Dam site	0	75	29	0	0	104	61	165
Access roads	0	0	52	7	19	78	0	78
Total	**0**	**2,601**	**832**	**280**	**103**	**3,816**	**2,653**	**6,469**

To provide a relative measure of the loss of agricultural land, the permanent loss of 6,469 ha was compared to areas with agricultural capability that have been mapped in the Peace River valley between the Peace Canyon Dam and the Alberta border, the Peace Agricultural Region, and the entire province (B.C.). These comparisons are summarized in Table 20.17.

Comparing Class 1 and 2 lands permanently lost, the 2,601 ha within the Project activity zone is:

- 24.8% of the Peace River valley total
- 2.1% of the Peace Agricultural Region total
- 1.0% of the provincial total

Comparing Class 1 through 3 lands permanently lost, the 3,433 ha within the Project activity zone is:

- 20.6% of the Peace River valley total
- 0.7% of the Peace Agricultural Region total
- 0.4% of the provincial total

Comparing Class 1 through 5 lands permanently lost, the 3,816 ha within the Project activity zone is:

- 19.0% of the Peace River valley total
- 0.1% of the Peace Agricultural Region total
- 0.04% of the provincial total

Table 20.18~~17~~ shows tenure and ALR status of the areas within the Project activity zone.

Table 20.17 Local, Regional and Provincial Comparison of Permanent Land Loss (ha), by Unimproved Capability

Area	Class 1	Class 2	Subtotal Class 1–2	Class 3	Subtotal Class 1–3	Class 4	Subtotal Class 1–4	Class 5	Subtotal Class 1–5	Subtotal Class 6&7	Total Class 1–7
PAZ	0	2,601	2,601	832	3,433	280	3,713	103	3,816	2,653	6,469
Peace River valley	926	9,551	10,477	6,150	16,627	1,949	18,576	1,480	20,056	35,031	55,087
PAZ as % of Peace River valley	0.0%	27.2%	24.8%	13.5%	20.6%	14.4%	20.0%	7.0%	19.0%	7.6%	11.7%
Peace Agricultural Region	3,833	121,013	124,846	365,043	489,889	501,036	990,925	1,683,351	2,674,276	2,091,078	4,765,354
PAZ as % Peace Agricultural Region	0.0%	2.1%	2.1%	0.2%	0.7%	0.1%	0.4%	0.0%	0.1%	0.1%	0.1%
Province	21,057	235,480	256,537	692,041	948,578	1,701,715	2,650,293	6,671,820	9,322,113	20,674,336	29,996,449
PAZ as % of Province	0.0%	1.1%	1.0%	0.1%	0.4%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%

NOTE:
PAZ – Project activity zone

Table 20.18 Tenure and Agricultural Land Reserve Within Project Activity Zone (ha), by Unimproved Capability

Tenure and ALR Status		Class 1	Class 2	Class 3	Class 4	Class 5	Class 1 – 5	Class 6&7	Total
BC Hydro	Non-ALR	0	71	24	3	0	98	155	253
	ALR	0	462	83	43	0	588	152	740
Private	Non-ALR	0	58	15	3	0	76	165	241
	ALR	0	260	19	43	3	325	46	371
Crown	Non-ALR	0	684	445	133	33	1,295	1,905	3,200
	ALR	0	1,066	246	55	67	1,434	230	1,664
	Total	**0**	**2,601**	**832**	**280**	**103**	**3,816**	**2,653**	**6,469**
By Tenure	BC Hydro	0	533	107	46	0	686	307	993
	Private	0	318	34	46	3	401	211	612
	Crown	0	1,750	691	188	100	2,729	2,135	4,864
	Total	**0**	**2,601**	**832**	**280**	**103**	**3,816**	**2,653**	**6,469**
By ALR Status	Non-ALR	0	813	484	139	33	1,469	2,225	3,694
	ALR	0	1,788	348	141	70	2,347	428	2,775
	Total	**0**	**2,601**	**832**	**280**	**103**	**3,816**	**2,653**	**6,469**

NOTE:
ALR – Agricultural Land Reserve

The majority (over 70%) of the more agriculturally capable lands within the Project activity zone are Crown lands. Of the remainder, BC Hydro owns more land than is currently under private ownership. The majority of the agriculturally capable lands are within the ALR, although over one-third is outside the ALR.

Of the total of 3,433 ha of Class 1 through 3 land within the Project activity zone:

- 640 ha or 18.6% is owned by BC Hydro
- 353 ha or 10.3% is privately owned
- 2,441 ha or 71.1% is Crown land
- 2,136 ha or 62.2% is within the ALR
- 1,297 ha or 37.8% is outside of the ALR

Comparing Class 1 through 5 lands yields similar proportions of tenure and ALR status. Of the total of 3,816 ha of Class 1 through 5 land within the Project activity zone:

- 686 ha or 18.0% is owned by BC Hydro
- 401 ha or 10.5% is privately owned
- 2,729 ha or 71.5% is Crown land
- 2,347 ha or 61.5% is within the ALR
- 1,469 ha or 38.5% is outside of the ALR

20.3.3.2 Permanent Land Loss by Utility

Permanently loss land was classified by agricultural utility as described in Section 20.2.4. These utility ratings are shown in Figure 20.4 Maps 1 through 16 and summarized by tenure and ALR status in Table 20.19.

Table 20.19 Land Lost by Utility, Tenure, and Agricultural Land Reserve Status (ha)

Tenure and ALR Status		High Utility	Moderate Utility	Total High and Moderate
By Tenure	Hydro	542	42	584
	Private	289	37	326
	Crown	468	288	756
	Total	**1,299**	**367**	**1,666**
By ALR Status	Non-ALR	212	53	265
	ALR	1,087	314	1,401
	Total	**1,299**	**367**	**1,666**

NOTE:
ALR – Agricultural Land Reserve

Table 20.20 Land Lost by Utility, Tenure, and Agricultural Land Reserve Status (%)

Tenure and ALR Status		High Utility	Moderate Utility	Total High and Moderate
By Tenure	Hydro	41.7%	11.4%	35.1%
	Private	22.2%	10.1%	19.6%
	Crown	36.0%	78.5%	45.4%
	Total	**100.0%**	**100.0%**	**100.0%**
By ALR Status	Non-ALR	16.3%	14.4%	15.9%
	ALR	83.7%	85.6%	84.1%
	Total	**100.0%**	**100.0%**	**100.0%**

NOTE:
ALR – Agricultural Land Reserve

Of the areas lost with high and moderate utility, the majority (approximately 45%) are Crown lands. Of the remainder, approximately 35% is owned by BC Hydro and approximately 20% is currently under private ownership. Most of the high and moderate utility areas, approximately 84%, are within the ALR.

An agricultural utility rating was also assigned to remaining land (land that would not be permanently lost) within the Peace River valley between the Peace Canyon Dam and the Alberta border, as described in Section 20.2.4.

Table 20.21 summarizes the utility ratings by tenure and ALR status.

Table 20.21 Remaining Land by Utility, Tenure, and Agricultural Land Reserve Status (ha)

Tenure and ALR Status		High Utility	Moderate Utility	Total High and Moderate
By Tenure	Hydro	609	60	669
	Private	6328	1271	7599
	Crown	2841	1418	4259
	Total	**9778**	**2749**	**12527**
By ALR Status	non-ALR	1356	1101	2457
	ALR	8422	1648	10070
	Total	**9778**	**2749**	**12527**

NOTE:
ALR – Agricultural Land Reserve

Table 20.22 Remaining Land by Utility, Tenure, and Agricultural Land Reserve Status (%)

Tenure and ALR Status		High Utility	Moderate Utility	Total High and Moderate
By Tenure	Hydro	6.2%	2.2%	5.3%
	Private	64.7%	46.2%	60.7%
	Crown	29.1%	51.6%	34.0%
	Total	**100.0%**	**100.0%**	**100.0%**
By ALR Status	Non-ALR	13.9%	40.1%	19.6%
	ALR	86.1%	59.9%	80.4%
	Total	**100.0%**	**100.0%**	**100.0%**

NOTE:
ALR – Agricultural Land Reserve

Of the remaining land with high and moderate utility, approximately 41% is privately owned. Of the remainder, about 34% is Crown land and approximately 5% is owned by BC Hydro. Most of the high and moderate utility areas, approximately 80%, are within the ALR.

Table 20.23 provides a comparison, by utility, for permanently lost and remaining land with the Peace River valley.

Table 20.23 Agricultural Utility Within the Peace River Valley (ha)

Area	High Utility	Moderate Utility	Total
Permanently lost land	1,299	367	1,666
Remaining land			
Left bank remaining	4,165	8,53	5,018
Downstream of Site C	5,613	1,896	7,509
Remaining land	**9,778**	**2,749**	**12,527**
Total Peace River valley	**11,077**	**3116**	**14,193**
% permanently lost	**11.7%**	**11.8%**	**11.7%**

Of the permanently lost land, 1,299 ha was identified as high utility, and 367 ha identified as moderate utility. Of the remaining lands within the Peace River valley, 12,527 ha were identified as having high or moderate utility, including 9,778 ha of high utility lands and 2,749 ha of moderate utility lands. Within the Peace River valley, the permanently lost land would represent:

- 11.7% of the total of 11,077 ha with high utility
- 11.8% of the total of 3,116 ha with moderate utility
- 11.7% of the total of 14,193 ha with high or moderate utility

20.3.4 Mitigation Measures – Agricultural Land Base

Recommended measures to mitigate potential adverse effects to the agricultural land base are described below.

20.3.4.1 Construction Activities

Construction activities would result in both the temporary and permanent loss of agricultural land.

Preliminary design of Highway 29 realignments considered agricultural effects and attempted to minimize those effects. During detailed design of project components that would affect agricultural land, including realignment of Highway 29, potential agricultural effects will be further considered and detailed designs will be developed to minimize effects on agricultural land to the extent practical.

20.3.4.1.1 Temporary Loss of Agricultural Land

Areas of temporary soil disturbance on agricultural lands will be reclaimed in accordance with the Project:

- Soil Management, Site Restoration, and Revegetation Plan
- Borrow and Quarry Sites Reclamation Plan
- Vegetation and Invasive Plant Management Plan

These plans will be developed before construction, and would be part of the overall construction environmental management framework as described in Volume 5 Section 35 Summary of Environmental Management Plans.

20.3.4.1.2 Permanent Loss of Agricultural Land

The majority of the loss of agricultural land base would occur during construction and reservoir filling. Additionally, relatively small amounts of agricultural land would be lost to erosion after the reservoir has been filled, and productivity in some areas may be affected by changes in groundwater elevations. Changes in groundwater elevations during operations may reduce the capability in some areas.

The agriculturally capable land that would be permanently lost cannot be replaced. The measures discussed below are enhancement measures that would improve productivity on remaining lands as a means to mitigate these losses. Such measures will be supported by the implementation of a proposed agricultural compensation fund, which is discussed in Section 20.3.9.

Mitigation measures that could be implemented to offset the permanent loss of agricultural lands and to improve the physical productivity of the unaffected agricultural land base within the Peace River valley and within the Peace Agricultural Region include the following:

- Irrigation improvements
- Drainage improvements
- Relocation of suitable quality soils
- Inclusion of land in the ALR

These measures will be investigated and implemented if they are determined to be technically and economically feasible. Each of these potential enhancement measures are discussed below.

Irrigation Improvements

Irrigation has been identified by several of the interviewed agricultural producers and industry representatives as a means of improving yields and the range of crops that can be successfully grown, although several stakeholders have noted that the costs of irrigating may not be justified by current revenues for many crops.

Although the costs of irrigation may not be justified by increased yields or crop diversification at this time, the availability of irrigation water in the future may benefit agriculture. Based on the analysis of climate data conducted as part of this assessment, the annual moisture deficit, which is crop water requirements less growing season precipitation with a one in 10-year probability of being exceeded, is estimated to be approximately 250 mm per year. The average annual moisture deficit is estimated to be 148 mm per year, but it is common practice to design irrigation systems to supply water for a drier than average year.

The actual amount of irrigation water that would have to be delivered to meet the moisture deficit would have to include an allowance for inefficiencies in water delivery and application. Applying a factor of 65% to account for these inefficiencies, the annual irrigation water requirement would be approximately 385 mm. With a reservoir area of 9,330 ha, the volume in a 0.5 m depth over the reservoir would be sufficient to irrigate approximately 12,000 ha.

BC Hydro does not have authority over issuance of Water Licences to support irrigation from the reservoir; however, BC Hydro will not oppose applications seeking to license water withdrawals from the reservoir for irrigation purposes. Accordingly, BC Hydro will support the Comptroller of Water Rights in its consideration of applications for Water Licences to support local valley-based irrigation projects.

Irrigation research, demonstration projects, and funding assistance for irrigation water supply infrastructure will be considered within the proposed agricultural compensation fund, which is discussed in Section 20.3.9.

Drainage Improvements

Some agricultural operators have noted on-farm drainage limitations, but the identified problems are limited in area. No large areas that would benefit from drainage improvements were identified during interviews.

Improved drainage in areas where poor drainage limits agricultural production would improve agricultural productivity. There may be environmental constraints to implementing drainage improvements, especially if the drainage works would affect areas of valuable habitat. Funding assistance for drainage improvements will be considered within the proposed agricultural compensation fund, which is discussed in Section 20.3.9.

Relocation of Suitable Quality Soil

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 areas of poorer quality soil or in low-lying, poorly drained areas to improve agricultural productivity.

Several of the interviewed agricultural producers indicated that there were areas that could be improved with soil relocation, and observations of other agricultural areas

outside of areas affected by interviewed operators suggest that there are other lands that could also be improved.

Although relocation of soils can improve agricultural productivity in certain locations, opportunities to implement this mitigation strategy will be constrained by concerns related to the following:

- Disturbance of archaeological sites
- Erosion and sediment control
- Weed control
- Habitat degradation

Soil relocation will be considered on a site-specific basis.

Surface soils will be salvaged from temporarily disturbed agricultural areas, such as temporary access roads and quarried and excavated materials source locations, and stored for later use in reclamation of these areas. Surface soils will also be salvaged from areas of new highway construction and used to reclaim or improve other areas.

Inclusion of Land in the Agricultural Land Reserve

Table 20.24 shows areas, by ownership, of Class 1 through 5 lands within the Peace River valley that are not within the ALR. The totals include land:

- On the left bank between Hudson's Hope and Site C, excluding land
  - Within the reservoir
  - Within the Erosion Impact Line
  - Within the dam site
  - Adjacent to tributaries
- Between Site C and the Alberta border, excluding land
  - On islands
  - Adjacent to the Pine River

Table 20.24 Land Capability, Class 1 – 5 Non-ALR (ha) (Unimproved)

Ownership	Class 1	Class 2	Class 3	Class 4	Subtotal Class 1 - 4	Class 5	Total
Hydro	8	48	98	0	154	0	154
Private	85	356	166	67	674	223	898
Crown	62	308	225	204	799	606	1405
Total	**155**	**712**	**489**	**271**	**1627**	**830**	**2357**

A total of 2,357 ha of Class 1 through 5 non-ALR lands were identified, of which 1,627 ha are Class 1 through 4. Of the Class 1 to 4 non-ALR lands, 154 ha (10%) are owned by BC Hydro, 674 ha (41%) are under private ownership, and 799 ha (49%) are Crown land.

There may be opportunities to include some of these agriculturally capable areas in the ALR to partially mitigate the loss of agricultural land. Including lands in the ALR would

not increase the amount of land with agricultural capability, but would reduce the opportunities for non-agricultural use on the included lands, increasing the likelihood that the areas would be used for agriculture.

However, there are issues that need to be considered:

- The possible reluctance of landowners to include land in the ALR and limit their land use options. Some landowners may expect to have other land excluded from the ALR or approved for non-farm use.
- Non-ALR land would likely be valued for non-farm use potential
- Competing resource uses, such as habitat use, particularly for Crown land
- Plans for future non-agricultural uses

BC Hydro will consult with government agencies and landowners to determine if there are opportunities to include agriculturally capable land in the ALR.

20.3.5 Effects Assessment – Construction – Agricultural Operations

The identification of potential effects to individual farms during construction is based on information collected during the interviews with agricultural owners and or operators, and on discussions with regulatory agency personnel.

Potential adverse effects on farm operations would include:

- Permanent loss of land and resulting loss of crop production and pasture capacity
- Temporary loss of land and resulting loss of crop production and pasture capacity, including soil disturbance and compaction
- Changes to grazing tenures and resultant loss of livestock carrying capacity
- Loss of farm infrastructure (buildings, farm utilities, and other improvements)
- Loss of irrigation and livestock watering facilities; changes to local hydrology, groundwater, and agricultural drainage
- Livestock access to the reservoir
- Changes to access routes to farm properties and to areas of agricultural activities within farms
- Changes to livestock movement
- Severance of farm properties
- Introduction and proliferation of invasive plant species
- Increased damage and loss of crops and stored livestock feed by wildlife
- Increased biosecurity risks
- Increased farm worker safety risks due to construction and operation of the facilities, including increased vehicular traffic during construction and the potential for induced or stray voltages from operation of the transmission works

20.3.5.1 On-Farm Effects

Table 20.25 shows which of the on-farm effects listed above would likely occur for each of the evaluated farms. Section 20.3.4.2 summarizes the permanent loss of land which was cultivated in 2011 and Section 20.3.4.3 summarizes the permanent loss of land which would occur within grazing tenures.

The loss of land and soil disturbance effect refers to the permanent loss of owned or leased land, the temporary loss of owned or lease farm land where disturbed areas can be rehabilitated, and the permanent loss of land within existing grazing tenures. The loss of land includes all tenures including private, BC Hydro-owned, and Crown land, and does not differentiate between ALR and non-ALR land.

Where livestock access to the reservoir is noted as a potential effect, it reflects potential restrictions on access for livestock watering, as well as safety hazards for the livestock around the reservoir.

Within the farm access effects include potential field access effects associated with the 85th Avenue Industrial Lands till source conveyor belt.

Table 20.25 Potential On-Farm Effects

Farm Number	Loss of Land, Production and Soil Disturbance			Infrastructure (Buildings, Septic Systems, etc.)	Water Supplies	Livestock Access to Reservoir	Access to and Within Farms			Fencing/Livestock Movement	Severance/Fragmentation
	Permanent, Owned, or Leased	Temporary, Owned, or Leased	Permanent Grazing Tenure				Highway 29	Within the Farm	Along/Across Highway 29		
1	✓	✓	✓	✓	✓	N/A	✓	N/A	✓	✓	✓
2	✓	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	✓	N/A
3	✓		✓	N/A	N/A	✓	N/A	✓	N/A	✓	N/A
4	✓	✓	N/A	✓	✓	✓	✓	✓	✓	✓	✓
5	N/A	N/A	N/A	✓	N/A	N/A	✓	N/A	N/A	N/A	N/A
6	✓	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	N/A	N/A
7	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	✓	N/A
8	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	✓	N/A
9	✓	✓	✓	N/A	N/A	✓	N/A	N/A	N/A	✓	✓
10	✓	N/A	N/A	✓	✓	N/A	✓	N/A	N/A	N/A	N/A
11	✓	N/A	N/A	✓	✓	N/A	✓	N/A	N/A	N/A	N/A
12	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	N/A	✓	N/A
13	✓	✓	N/A	N/A	N/A	N/A	N/A	✓	N/A	✓	N/A
14	✓	✓	N/A	N/A	N/A	N/A	✓	✓	N/A	✓	N/A

Farm Number	Loss of Land, Production and Soil Disturbance			Infrastructure (Buildings, Septic Systems, etc.)	Water Supplies	Livestock Access to Reservoir	Access to and Within Farms			Fencing/Livestock Movement	Severance/Fragmentation
	Permanent, Owned, or Leased	Temporary, Owned, or Leased	Permanent Grazing Tenure				Highway 29	Within the Farm	Along/Across Highway 29		
15	✓	✓	N/A	N/A	N/A	N/A	✓	✓	✓	✓	✓
16	✓	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	✓	N/A
17	✓	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	✓	N/A
18	✓	N/A	✓	✓	✓	N/A	N/A	N/A	✓	✓	✓
19	✓	N/A	✓	✓	N/A	✓	✓	✓	N/A	✓	N/A
20	N/A	✓	N/A	N/A	N/A	N/A	N/A	✓	N/A	N/A	N/A
21	N/A	✓	N/A	N/A	N/A	N/A	N/A	✓	N/A	N/A	N/A
22	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	✓	N/A
23	✓	N/A	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A
24	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
25	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	✓	N/A
26	✓	✓	N/A	✓	N/A	N/A	✓	N/A	N/A	N/A	✓
27	✓	N/A	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A
28	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	✓	N/A
29	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	✓	N/A	N/A	N/A	✓	N/A	✓	N/A	N/A	✓	N/A
31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32	✓	N/A	N/A	N/A	N/A	✓	N/A	N/A	✓	✓	N/A
33	✓	N/A	N/A	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
34	✓	N/A	N/A	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTE:
N/A – not applicable (no effect is anticipated)

In addition to the agricultural effects listed in Table 20.25 above, there are additional potential effects that are applicable to many of the farm operations, including:

- Introduction of weeds
- Increased traffic on Highway 29
- Increased unauthorized access
- Increased damage and loss of crops and stored livestock feed resulting from changes in wildlife migrations and habitat use patterns

Increased biosecurity risks and safety issues related to induced or stray voltages from operation of the transmission works were not noted as concerns by any of the interviewed farm operators.

20.3.5.2 Permanent Loss of Cultivated Land

Table 20.26 summarizes the permanent loss of cultivated land for each of the operations where there is currently cultivated land within the Project activity zone. Operations not listed in this table would not permanently lose currently cultivated land. The areas of cultivated land include private land, BC Hydro-owned private land, and Crown land.

Table 20.26 Summary of Loss of Cultivated Land by Agricultural Operation (ha)

Cultivation, by Farm No.		Canola	Grain	Forage	Pasture	Total	Percentage Cultivated Land Remaining
1	Current	0	78	420	122	620	
	Lost	0	0	45	0	45	
	Remaining	0	78	375	122	575	92.7%
3	Current	0	0	224	64	288	
	Lost[c]	0	0	0	1	1	
	Remaining	0	0	224	63	287	99.7%
4	Current	0	0	104	23	127	
	Lost[c]	0	0	104	0	104	
	Remaining	0	0	0	23	23	18.1%
15	Current[a]	NA	NA	NA	NA	NA	
	Lost	0	0	14	0	14	
	Remaining	NA	NA	NA	NA	NA	NA
17	Current[a]	NA	NA	NA	NA	NA	
	Lost[c]	0	0	4	0	4	
	Remaining	NA	NA	NA	NA	NA	NA
18	Current	79	0	280	56	415	
	Lost	79	0	39	56	174	
	Remaining	0	0	241	0	241	58.1%
19	Current[b]	NA	NA	NA	NA	NA	
	Lost[c]	34	0	5	3	42	
	Remaining	NA	NA	NA	NA	NA	NA
23	Current	14	0	0	0	14	
	Lost	2	0	0	0	2	
	Remaining	12	0	0	0	12	85.7%
24	Current	20	0	113	24	157	
	Lost	2	0	8	7	17	
	Remaining	18	0	105	17	140	89.2%
26	Current	0	0	119	0	119	
	Lost[c]	0	0	20	0	20	
	Remaining	0	0	99	0	99	83.2%

Cultivation, by Farm No.		Canola	Grain	Forage	Pasture	Total	Percentage Cultivated Land Remaining
27	Current	0	0	0	37	37	
	Lost	0	0	0	1	1	
	Remaining	0	0	0	36	36	97.3%
33	Current	0	165	104	0	269	
	Lost	0	90	12	0	102	
	Remaining	0	75	92	0	167	62.1%
34	Current[b]	NA	NA	NA	NA	NA	
	Lost	0	0	0	15	15	
	Remaining	NA	NA	NA	NA	NA	NA
Total lost cultivated land		**117**	**90**	**251**	**83**	**541**	

NOTES:

[a] Estimates of currently cultivated land are not available because the operator either declined to or did not respond to an interview request

[b] Estimates of currently cultivated land are not available because the operation includes lands outside of the Peace River valley and detailed information on cultivation on these lands was not obtained

[c] The Percentage Cultivated Land Remaining includes an overestimate of land loss due to inclusion of Highway 29 realignment corridors where final alignment is uncertain

NA – data not available

Approximately 541 ha of currently cultivated land are within the Project activity zone. Cropping of this area in 2011 included 117 ha of canola, 90 ha of grain, 251 ha of forage, and 83 ha of improved pasture.

Information was available to estimate the loss of cultivated land for 14 agricultural operations. The three operations that would experience the greatest effect would have up to approximately 18%, 58%, and 62% of currently cultivated land remaining. A further three operations would have between 80% and 89% remaining, three operations would have between 90% and 99% remaining, and five operations would experience no loss of currently cultivated land.

At the owner's request and at BC Hydro's discretion, BC Hydro may purchase entire farming operations where there are proportionally large losses of cultivated land.

The loss of land on some affected farms may result in the sale of livestock herds associated with those operations. This would be discussed with the owners of the affected farms and, where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.5.3 Permanent Loss of Grazing Land

Table 20.27 shows the areas of current grazing leases and grazing licences that are within the Project activity zone and that would incur a permanent loss of land. These areas are included in the summaries of permanent land loss by capability class and the potential effects to individual agricultural operations are summarized in Section 20.3.2.4. The estimated areas of permanent loss of land include those that would occur during construction and operations.

Table 20.27 Permanent Land Losses – Grazing Tenures

Tenure Number	Crown Grazing Tenure	Total Area of Tenure (ha)	Dam Site	Reservoir	Erosion	Transmission Line	Highway 29 Realignment	Construction Access	Quarried and Excavated Materials	Permanent Land Loss (ha)	% Total Area Lost
1	Licence	252	N/A	✓	✓	N/A	N/A	N/A	N/A	2	0.8%
2	Lease	8,271	N/A	✓	✓	N/A	N/A	N/A	N/A	200	2.4%
4	Licence	258,523	N/A	✓	✓	N/A	N/A	N/A	N/A	7	0.003%
8	Licence	5,228	✓	✓	✓	✓	N/A	✓	✓	234	4.5%
9	Licence	345	N/A	✓	✓	N/A	N/A	N/A	N/A	250	72.5%
10	Licence	17,227	N/A	✓	✓	N/A	N/A	N/A	N/A	267	1.5%
11	Licence	813	N/A	✓	✓	N/A	N/A	N/A	N/A	127	15.6%
15 &16	Lease	730	N/A	✓	✓	N/A	N/A	N/A	N/A	96	13.2%
Total										**1183**	**N/A**

NOTE:
N/A – not applicable

Four tenures have areas within the stability or Flood Impact Line. No permanent loss of land is assumed for areas within the Stability or Flood Impact Lines as the likelihood of permanent loss of land is low.

Three tenures would be affected only by activities associated with the transmission line and, therefore, the permanent loss of land within these tenures is negligible.

Three tenures would be affected by temporary access roads. These roads would be reclaimed with no permanent loss of agricultural land.

Tenures 15 and 16, which are two contiguous leases that are part of the same agricultural operation, may effectively lose an additional 137 ha of grazing lease area, as the reservoir may prevent access to a portion of this tenure. This would increase the loss to 31.9% of the total tenure area. The additional area is steep, north-facing, and of lower productivity than the remainder of the tenure area.

For those tenures that would experience a permanent loss of land, the loss ranges from 0.003% through 72.5% of the total area. Five of those tenures lose less than 5% of the total tenure area.

As discussed in Section 20.2.6, the B.C. Ministry of Forests, Lands and Natural Resource Operations (2011) indicated that range carrying capacity in the Peace River valley generally varies from 3.2 through 6.1 ha per animal unit month (AUM), and information from Range Use Plans showed carrying capacities varying from 2.3 through 20.7 ha per AUM. Assuming an average 4.7 ha per AUM, the permanent loss of land within grazing tenures would represent a loss of approximately 252 AUMs.

20.3.6 Effects Assessment – Operations – Agricultural Operations

Potential effects that would be experienced during operation of the Project include effects due to erosion, potential changes in groundwater elevations, effects of road

maintenance and vegetation management along the transmission line right-of-way, and potential reservoir-induced changes to microclimate:

- Estimates of permanent loss of land within the Erosion Impact Line have been included in the discussion in Section 20.3.2.1
- Flooding within the Flood Impact Line may result in crop losses when flooding occurs
- Changes in groundwater elevations, discussed in Section 20.3.2.2, will be evaluated to determine if there are any effects on agricultural operations
- Effects of transmission line operation activities are discussed in Section 20.3.2.3

Predicted changes in microclimate are described in Volume 2 Section 11.10 Microclimate. These predicted changes were analyzed to assess potential microclimate effects to farm operations. The results of this analysis are described in Volume 3 Appendix D Agricultural Assessment Supporting Documentation and summarized below:

- Agricultural productivity may increase due to a longer frost-free period
- Increases in humidity in the late summer and fall, which could increase the time required for crop drying in areas close to the reservoir
- No change on winter wind chill effects on livestock is expected, as no statistically significant changes to winter wind chill factors are predicted
- No effects on irrigation water requirements are expected, as no statistically significant changes to potential evapotranspiration or growing season precipitation are predicted
- No effects on overwintering perennial crops are expected, as no statistically significant changes to winter precipitation or winter minimum temperatures are predicted
- No effects on field trafficability (the ability of the soil to bear traffic without damage to soil structure) are expected, as no statistically significant changes to evapotranspiration or growing season precipitation are predicted

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 the 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.

20.3.7 Mitigation Measures – Agricultural Operations

Measures and strategies to mitigate potential adverse effects to agricultural operations during construction and operation of the Project are discussed below.

20.3.7.1 Construction

Potential effects to agricultural operations during project construction are discussed in Section 20.3.4. Construction mitigation measures to minimize potential effects associated with loss of agricultural land from farm operations are discussed below.

20.3.7.1.1 Permanent Loss of Agricultural Land

The loss of agricultural land crop production and grazing may be partially mitigated by improving the capability or productivity of remaining land. This may be achieved by relocating surface soils from areas of permanent disturbance and placing them in areas outside of the Project activity zone, and by reclaiming abandoned sections of Highway 29, as described in Volume 1 Section 4 Project Description. Abandoned sections of Highway 29 or other roads that are adjacent to agriculturally capable lands will be reclaimed in accordance with the Project Soil Management, Site Restoration, and Revegetation Plan, as described in Volume 5 Section 35 Summary of Environmental Management Plans.

Agricultural land that is required for the Project will be acquired and associated financial losses, if any, will be reimbursed as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.7.1.2 Farm Operational Effects

Construction-related effects to individual farms, including the temporary loss or disturbance to land, will be mitigated with the implementation of best management practices and environmental management plans, or by providing compensation to the farm to replace lost infrastructure or offset higher operating costs, based on farm-specific appraisals.

Table 20.28 lists potential effects to agricultural operations during project construction, other than permanent loss of land, and the mitigation measures that will be implemented.

Table 20.28 Mitigation of Operation-Specific Effects

Effect to Farm Operation	Mitigation Measures to Be Implemented
Temporary loss of land	Compensation will be provided for temporary loss of land or soil disturbance; temporarily disturbed land will be reclaimed in accordance with the Project Soil Management, Site Restoration, and Revegetation Plan
Disruption of farming operations during construction[a]	Disruptions will be mitigated or compensation provided for increased operational costs
Disruption of livestock movement patterns	Alternative livestock movement options and compensation for associated increased costs will be provided
Loss of farm infrastructure (buildings, corrals, septic fields, etc.)	Infrastructure will be relocated or replaced, or appropriate compensation provided
Loss of water supplies	Alternative water supplies will be provided or appropriate compensation provided
Farm yard and field access	Alternative access will be provided
Equipment and livestock crossings of Highway 29	Alternative highway crossings will be provided
Current and potential Highway utility (water, electricity) crossings	Alternative utility crossings will be provided
Loss or disruption of livestock watering or drainage works	Alternative livestock watering and drainage works will be provided during construction, and original works will be restored after construction is completed
Highway traffic and congestion	A Traffic Management Plan will be implemented
Increased public access during construction	Access to farm properties by construction workers will be minimized and measures to minimize unauthorized public access will be implemented
Loss of fencing	Fencing will be replaced or compensation for replacement fencing will be provided
Severance or fragmentation of farm properties	Fragmented parcels will be consolidated with other parcels, where practical and when owner(s) agree(s)
Introduction and proliferation of invasive plant species	A Vegetation and Invasive Plant Management Plan will be implemented
Farm worker safety	A Public Safety Management Plan will be implemented

NOTE:

[a] Includes disruptions to equipment and livestock movement which would result from the 85th Avenue Industrial Lands till source conveyor belt

Potential risks associated with the transmission of livestock diseases were not identified as a concern by any of the interviewed farm operators. However, if the potential for disease transmission becomes a concern (for example, if a communicable livestock disease is identified in the area), appropriate biosecurity protocols will be developed and implemented.

Following the project approval process, professional appraisals and Farm Mitigation Plans will be developed for each of the directly affected farms, in consultation with the owner and or operator. These plans will describe appropriate mitigation measures, including compensation, to address potential effects for each agricultural operation. Implementation of Farm Mitigation Plans, including appropriate compensation, will mitigate construction-related effects to farm operations.

20.3.7.2 Operation Activities

The following discusses mitigation measures to address potential effects to agricultural activities during the operational phase of the Project. The potential effects include:

- Damage and loss of crops and stored livestock feed resulting from changes in wildlife migrations and habitat use patterns
- Reduced crop drying and consequent reduction in quality that may result from increased humidity during the summer and fall at farms close to the reservoir
- Reduced productivity from changes in groundwater elevations
- Increased public access to farm properties
- Increased livestock safety risks due to access to the reservoir

20.3.7.2.1 Wildlife Damage

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. All potential project effects will be discussed with directly affected property owners and, where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.7.2.2 Crop Drying

Reservoir-induced local climate effects on agriculture are anticipated to be limited to possible effects on crop drying within 1 km of the reservoir. Predicted increases in humidity during the summer and fall may influence crop drying. All potential project effects will be discussed with directly affected property owners and, where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.7.2.3 Change in Groundwater Elevation

Reservoir0influenced changes in groundwater elevations are expected to be limited to within 2 km of the reservoir. If groundwater elevations adjacent to the reservoir rise close to the ground surface on agricultural lands, the range of suitable crops and crop yield may be reduced. In other cases, groundwater elevation changes may improve agricultural conditions. All potential project effects will be discussed with directly affected property owners, and where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.7.2.4 Unauthorized Public Access to Farm Properties

The reservoir may increase opportunities for unauthorized access to some farm properties by providing boat access to areas that are currently difficult to access. Concerns in this regard will be evaluated on a farm-specific basis and the issue will be discussed with directly affected landowners and, where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.7.2.5 Livestock Access to the Reservoir

Some farm operators may benefit from livestock access to the reservoir for watering, while others may be concerned that there may be a risk to livestock falling into the reservoir. These concerns will be evaluated on a farm-specific basis and the issues will be discussed with affected landowners and, where appropriate, agreements would be entered into as described in Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements.

20.3.8 Effects Assessment – Construction – Agricultural Economic Activity

The major effects to agricultural economic activity would be associated with the foregone economic activity that results from the loss of agricultural land.

20.3.8.1 Agricultural Land in the Project Activity Zone

The area and characteristics of agricultural land that would be affected by the Project are described in Sections 20.3.1 and 20.3.2. These previous sections have explained that some Class 1 through 5 lands are of low to nil utility for cultivated agriculture because of their location, configuration, lack of access, or designated use for non-agricultural purposes. Class 6 and 7 lands are rated as having low to nil utility, although some of these lands can be used for grazing.

Table 20.29 summarizes the agricultural land affected by the Project by capability and utility.

Table 20.29 Summary of Lost Agricultural Land (ha), by Utility and Capability

Land Category	Subtotal Class 1–5	Subtotal Class 6–7	Total in PAZ
Total high to moderate utility	1,666	0	1,666
Total low to nil utility	2,150	2,653	4,803
Total	**3,816**	**2,653**	**6,469**

NOTES:
PAZ – Project activity zone
Unimproved rating

A total of 6,469 ha are within the Project activity zone, of which 3,816 ha are Class 1 through 5, and 2,653 ha are Class 6 and 7. Of the 3,816 ha of Class 1 through 5, 1,666 ha are rated as having high to moderate utility for agricultural use, and 2,150 ha are rated as having low to nil utility for cultivated agriculture. Of the 1,666 ha of high to moderate utility land, 541 ha are currently cultivated, and 1,125 ha are not cultivated.

There are 2,653 ha of low to nil utility that are rated Class 6 and 7. Some of this area could be used for grazing. The current area of grazing licences and leases within the Project activity zone is 1,183 ha. This includes areas of high, moderate, and low to nil utility.

There is also potential for construction activities to affect farming operations near the Project activity zone. Although these effects have the potential to create economic losses associated with temporary disruptions to agricultural operations, impacts other than those associated with the loss of land have not been included in this evaluation on agricultural economic activity. If these other effects cannot be mitigated, compensation

will be provided to individual farm operations resulting in no net effect on regional agricultural economic activity.

20.3.8.2 Agricultural Land Use Without the Project

In assessing project effects on agricultural economic activity, the following assumptions were made regarding future land use without the Project:

- The currently cultivated land would continue to be farmed
- The unused Class 1 through 5 high to moderate utility lands would become fully developed for cultivation over time
- The unused Class 1 through 5 low to moderate 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

Table 20.30 indicates the projected extent of fully developed future agricultural land use within the Project activity zone, assuming that the Project did not proceed.

Table 20.30 Future Agricultural Land Use Without the Project (ha)

Land Category	Land Use		
	Cultivated	Grazing	Total
	ha		
High to moderate utility	1,666	0	1,666
Class 1 to 5 low to nil utility	0	2,150	2,150
Class 6 and 7	0	1,327	2,653
Total	**1,666**	**3,477**	**6,469**

NOTE:
Unimproved rating

The projected future agricultural land use within the Project activity zone without the Project is assumed to be:

- 1,666 ha of cultivated land
- 3,477 ha of grazing land

20.3.8.3 Foregone Agricultural Economic Activity

Implementation of the Project would result in the loss of all agricultural land within the Project activity zone and the corresponding loss of agricultural economic activity associated with those lands. In estimating the value of foregone agricultural economic activity, the net present value of agricultural production that would occur from land within the Project activity zone without the Project was estimated under different land use scenarios. As the loss of land would occur over several years during the construction period, the net present value of any production from Project activity zone lands that would continue to occur during construction was also estimated and deducted from estimated value of production without the Project to determine an overall net value of foregone agricultural economic activity.

The analysis of foregone agricultural economic activity is summarized in the following sections. Additional information on this analysis is contained in Volume 3 Appendix D Agricultural Assessment Supporting Documentation.

20.3.8.4 Agricultural Economic Activity Without the Project

Estimates of the present value of the returns to agricultural land within the Project activity zone without the Project were based on the following assumptions:

- Future growth and development starts from the current level and type of agricultural activity
- Three alternative scenarios of the pattern of future agricultural development are considered:
    - Scenario 1 is based on expansion of the current cropping mix, with no new crop types added. The total area in crops and the area of grazing both increase to the amounts shown in Table 20.31.
    - 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

Table 20.31 Future Agricultural Development Scenarios

Crop	Year							
	1	5	10	15	20	25	50	100
	ha							
Scenario 1								
Vegetables	0	0	0	0	0	0	0	0
Canola	117	129	141	153	166	178	239	360
Grain	90	99	109	118	127	137	184	277
Forage	251	277	303	329	355	381	512	773
Pasture	83	92	100	109	118	126	169	256
Range	1,183	1,298	1,412	1,527	1,642	1,757	2,330	3,477
Idle	3,419	3,248	3,077	2,906	2,735	2,564	1,710	0
Total ha	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**
Scenario 2								
Vegetables	0	5	10	15	20	25	50	100
Canola	117	128	139	150	161	172	228	339
Grain	90	99	107	116	124	133	175	261
Forage	251	275	299	322	346	370	489	727
Pasture	83	91	99	107	114	122	162	240
Range	1,183	1,298	1,412	1,527	1,642	1,757	2,330	3,477
Idle	3,419	3,248	3,077	2,906	2,735	2,564	1,710	0
Total ha	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**
Scenario 3								
Vegetables	0	10	20	30	40	50	100	200
Canola	117	127	137	147	157	167	217	317
Grain	90	98	105	113	121	128	167	244
Forage	251	272	294	315	337	358	466	680
Pasture	83	90	97	104	111	118	154	225
Range	1183	1,298	1,412	1,527	1,642	1,757	2,330	3,477
Idle	3419	3,248	3,077	2,906	2,735	2,564	1,710	0
Total ha	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**	**5,143**

- Growth in agricultural use is assumed to occur at a constant rate over time. The base case evaluation assumes full development would occur within 100 years of the estimated first year of construction (that is, by year 100). The sensitivity of the present value of agricultural effects to three different time frames to full development has been considered:
  - 50 years from the estimated start of project construction
  - 100 years from the estimated start of project construction
  - 150 years from the estimated start of project construction
- Two time periods have been used to estimate foregone agricultural returns due to the Project:
  - Period A: Project-related lost returns are calculated over a 100-year horizon. This time period is assumed for the base case evaluation of foregone agricultural activity.

  - Period B: Project-related lost returns are calculated in perpetuity
- Over the first 100 years of the analysis period, the real terms of trade for agricultural products are assumed to improve by 0.5% per annum relative to the prices of all other products and services in the economy. This translates to real prices for agricultural products increasing at this rate. The sensitivity of the present value of displaced agricultural returns to this assumption has been examined using the following alternative rates:
  - 0.25% annual growth rate
  - 0.5% annual growth rate
  - 0.75% annual growth rate
- For base case present value calculations, the following social discount rates have been used:
  - Discount Rate 1: 3.5% per annum for displaced agricultural returns within the first 50 years following project implementation
  - Discount Rate 2: 2.5% per annum for the foregone returns in the second 50 years
  - Discount Rate 3: 2% per annum for the foregone returns in the second 100-year period following project implementation (Period B only)
  - Discount Rate 4: 1.5% per annum for any foregone returns after 200 years (Period B only)

The sensitivity of the evaluation to alternative discount rates during the first 100 years has been tested by varying Discount Rates 1 and 2 by ±0.5%, with the discount rate in years 51 to 100 set at 1% lower than the discount rate in years 1 to 50.

The sensitivity of the evaluation has also been tested by varying the project horizon in the base case to Period B (in perpetuity) and varying the discount rates during the first 100 years, with the discount rate set 1% lower in years 51 to 100 than it is in years 1 to 50.

20.3.8.5 Agricultural Economic Activity During Construction

To estimate the agricultural economic activity that would be generated from land within the Project activity zone during the construction period, it was assumed that:

- The area of cultivated land would be unaffected until construction year 5, and then decrease by equal annual amounts until reaching zero in the final construction year 8
- The area of grazing land would decrease in equal annual amounts starting in construction year 1 and reaching zero in construction year 10. This assumes that the use of grazing areas would be affected by land clearing activities before effects to cultivated land would occur.

The estimate of agricultural economic activity during construction is based on:

- Enterprise budgets of returns to land from canola, grains, forage, pasture, and grazing production as described in Volume 3 Appendix D Agricultural Assessment Supporting Documentation

- An annual growth of 0.5% per year to the real value of agricultural revenues
- An interest on investment rate matching the rate used for Discount Rate 1 in the base case evaluations and in the various sensitivity analyses

Table 20.32 shows the assumed agricultural land use within the Project activity zone during construction and the estimated returns to land over the construction period.

Table 20.32 Schedule of Farming Cessation During Construction in the Project Activity Zone

Year	Cultivated Area	Grazing Area	Annual Returns to Land (Year 1$ Dollars)
	ha		
0	541	1,183	
1	541	1,065	161,485
2	541	946	164,251
3	541	828	166,890
4	541	710	169,402
5	541	592	171,788
6	541	473	174,047
7	406	355	134,713
8	271	237	92,594
9	135	118	47,689
10	0	0	0

20.3.8.6 Net Foregone Primary Agricultural Economic Activity

BC Hydro proposes an analysis period of 100 years (Period A) starting with the commencement of project construction. Within this time frame, the base case valuation of foregone agricultural economic activity uses the following assumptions:

- Full utilization of the farmland base over 100 years
- Scenario 2, which allows for 100 ha of vegetable production at full development
- Annual growth in the real value of agricultural production of 0.5%
- The following social discount rates:
  - Discount Rate 1 (1 to 50 years) of 3.5%
  - Discount Rate 2 (51 to 100 years) of 2.5%

As shown in Table 20.33, the present value of this base case is estimated to be $22.3 million (in Year 1 dollars).

Table 20.33 also summarizes results of a sensitivity analysis where various parameters were adjusted from that of the base case. In this sensitivity analysis, foregone agricultural returns range from a low of $13.0 million to a high of $36.6 million. This summary shows that the base case valuation is most sensitive to the following:

- The length of the period over which foregone benefits are calculated
- The area of vegetable production included

- The length of the period over which the full development of the agricultural potential of the Project activity zone is assumed to occur

Modifying the project horizon in the base case to Period B (in perpetuity) and varying the discount rates generates a range of estimated net present values of foregone economic activity to between $26.2 and $ 52.7 million.

The assumptions used in the sensitivity analysis are summarized in Section 20.3.8~~7~~.4.

Table 20.33 Sensitivity Analysis of Foregone Agricultural Economic Activity

Parameter Varied (others held constant as in base case)	Economic Valuation (Year 1$, million)		
	Low	Base	High
Development scenario (1, 2, or 3)	$13.0	$22.3	$31.5
Development period (50, 100, or 150 years)	$17.2 $22.3		$31.0
Annual real growth rate (0.25%, 0.5%, or 0.75%)	$17.3 $22.3		$28.4
Foregone benefits period (100 years or in perpetuity)	N/A $22.3		$36.6
Discount rate (base rate ±0.5%)	$17.2	$22.3	$29.4

20.3.8.7 Foregone Secondary Agricultural Economic Activity

Table 20.34 estimates expected Project activity zone revenues and direct expenses, in Year 1$, in Year 1, and in Year 100 under cropping Scenario 2. The expected values are based on average historical prices, yield, and revenue-expense relationships.

It is estimated that current agricultural activity in the Project activity zone could produce a gross return of $392,000 in Year 1, with expansion in Year 100 to approximately $1,628,000 in Year 1 dollars. These revenues represent only 0.3% and 1.1%, respectively, of total gross farm receipts of $144.9 million generated in the Peace Agricultural Region in 2010 (Statistics Canada 2012a). As such, the estimated revenue streams generated by agriculture in the Project activity zone represent a small proportion of current Peace Agricultural Region agriculture revenues, and are projected to represent only about 1% of gross farm receipts, even with possible future development expansion into vegetables and utilization of currently unused farmland within the Project activity zone. This calculation does not adjust for likely growth in Peace Agricultural Region agricultural activity outside of the Project activity zone. The impact of the direct loss of these revenues is likely to be low in terms of effect on direct investment in the regional agricultural economy.

Table 20.34 Estimated Revenues and Expenses Associated With Project Activity Zone Cropping

Crop	Year 1 (Year 1$)			Year 100 (Year 1$)		
	Area (ha)	Total Gross Farm Receipts	Total Direct Expenses	Area (ha)	Total Gross Farm Receipts	Total Direct Expenses
Vegetables	0	0	0	100	493,857	171,703
Canola	117	150,151	69,473	339	434,633	201,099
Grains	90	82,134	40,048	261	237,749	115,924
Forage	251	120,972	52,991	727	350,169	153,390
Pasture	83	30,752	5,841	240	89,015	16,908
Range	1,181	7,607	4,082	3,477	22,404	12,023
Total – PAZ	1,722	391,615	172,435	5,143	1,627,827	671,047
Peace Agricultural Region[a]	2,522,867	144,940,291	137,165,740	NA	NA	NA

NOTES:
[a] Statistics Canada 2012a
PAZ – Project activity zone
NA – not available, future revenue and expenses for the Peace Agricultural Region were not estimated

Another way of looking at lost economic activity is in terms of the effect of farm-related expenditures on the demand for farm inputs and services. Table 20.34~~5~~ indicates that total direct expenses related to Project activity zone agriculture could range between approximately $172,000 and $671,000 annually, assuming an expansion into 100 ha of vegetables. Relative to 2010 expenditures in the Peace Agricultural Region of $137.2 million (Statistics Canada 2012a) expenses in the Project activity zone would represent between 0.1% and 0.4% of regional agricultural expenses, depending on future development in the Project activity zone and not taking into consideration agricultural growth in other parts of the region.

Data on economy multipliers for the Canadian agriculture and agri-food sector (Agriculture and Agri-Food Canada 2007) indicate that for every dollar of direct gross domestic product (GDP) created in primary farm gate-level agriculture, an additional $1.80 in indirect spending is generated. Application of this factor to the estimates of primary agricultural activity within the Project activity zone results in estimates of between approximately $310,000 (Year 1) and $1.21 million (Year 100) in foregone annual secondary spending.

Data on the Canadian agriculture and agri-food sector (Agriculture and Agri-Food Canada 2007) also indicate that for every job created in primary agriculture, another 0.91 indirect jobs are created in the economy. Based on the ratio of farm employment to gross farm receipts in the region as whole, it is estimated that paid employment in the Project activity zone, based on an estimate of 49 weeks of employment per year per full-time worker, was 1 to 2 person-years in 2010 (Statistics Canada 2012a), but could rise to 3 to 4 person-years with future development within the Project activity zone. This analysis does not account for family labour for which no formal wages are paid. As outlined in Section 20.2.8.2, only about 20% of farms in the Peace Agricultural Region pay formal wages.

20.3.9 Effects Assessment – Operations – Agricultural Economic Activity

The assessment of effects on agricultural economic activity is based on the permanent loss of land. As the majority of the permanent loss of land would occur during construction, the effects assessment of Section 20.2.7 includes the small amount of erosion-related loss that would occur during the operational phase of the Project. Effects during operations have not been assessed separately from those during construction.

20.3.10 Mitigation Measures – Change in Agricultural Economic Activity

Mitigation measures to address changes in agricultural economic activity include measures to improve the productivity of remaining agricultural land to increase the level of agricultural economic activity.

20.3.10.1 Construction

Changes in agricultural economic activity would result from the permanent loss of agricultural land, and almost all of the permanent loss of land would occur during construction.

20.3.10.1.1 Permanent Loss of Agricultural Land

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. These projects will focus on enhancements to 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 ALC, the B.C. Ministry of Agriculture, and the local agricultural community. A series of workshops with representatives from local and regional agricultural organizations and agencies is considered the first step in designing the administrative and governance structure of the fund, and in determining the types of projects that may receive funding assistance.

Types of projects that the proposed fund may support are listed below, recognizing that some 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 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

20.3.10.2 Operations

The majority of the Project activities that would affect agricultural economic activity will occur during construction. Additional agricultural land may be lost due to erosion during operations and affect agricultural economic activity. Measures to mitigate this additional loss of land are the same as those discussed above.

20.3.11 Effects Assessment – Construction – Food Production and Consumption

Table 20.35 summarizes the area of farmland in the Project activity zone and compares these areas to regional and provincial totals. The comparisons assume no increase in farmland use in the region from 2013 through 2112 other than in the Project activity zone.

Table 20.35 Summary Project Activity Zone, Regional and Provincial Farmland Totals

Geographic Area, Year, Data Source	Land in Crops (ha)	Percent of B.C. Total	Tame & Seeded Pasture (ha)	Total (ha)	Percent of B.C. Total
PAZ, projected Year 1	458	0.076%	83	541	0.065%
Peace Agricultural Region, 2011 Census	270,506	45.1%	100,406	370,912	44.9%
B.C., 2011 Census	599,674	100.0%	226,298	825,972	100.0%
PAZ, projected Year 100	1410	0.235%	256	1,666	0.202%
Peace Agricultural Region, 2011 Census	270,506	45.1%	100,406	370,912	44.9%
B.C., 2011 Census	599,674	100.0%	226,298	825,972	100.0%

NOTE:
PAZ – Project activity zone

Table 20.35 indicates that the Peace Agricultural Region encompasses 44.9% of the currently cultivated land in B.C.

The area that could be cultivated in the Project activity zone is estimated to be the 1,666 ha that was rated as having high or moderate utility. This 1,666 ha represents 0.4% of the currently cultivated land in the Peace Agricultural Region and 0.2% of the currently cultivated land in the province.

Land currently in crops in the Project activity zone represents 0.17% of the Peace Agricultural Region's land in crops. Without the Project, this assessment projects maximum agricultural development of the Project activity zone to occur by Year 100. With this projected full utilization within the Project activity zone, land in crops within the

Project activity zone would represent 0.52% of the Peace Agricultural Region's 2011 area of land in crops.

20.3.11.1 Short-Term Effects

The short-term effect of the Project on regional self-reliance is anticipated to be low to non-existent since there has been, prior to 2012, little or no vegetable or fruit cropping in the Project activity zone, except for home gardens, for the past several years. There was one market garden operation within the Project activity zone in 2012. However, the potential for vegetable production in the Project activity zone cannot be discounted, as it could occur if future market developments were to create economic opportunities. Most of the currently minor amount of Peace Agricultural Region commercial vegetable production occurs on farmland outside of the Project activity zone and could be increased by demand from a growing population, including that created by construction workers on the Project.

20.3.11.2 Long-Term Effects

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 20.36 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 71,00	0	255	511
2036 93,10	0	335	670
2062 122,1	00	439	878
2112 209,9	00	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

For 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.

Self-reliance in dairy, meat, and egg and poultry products does not require higher capability farmland to support production. As such, the Project is not anticipated to be a determinant to achieving high levels of food self-reliance in these commodities, if economic conditions were to encourage such a trend.

20.3.12 Effects Assessment – Operations – Food Production and Consumption

The assessment of potential effects on food production and consumption is based on the permanent loss of land. As almost all of the permanent loss of land would occur during construction, the effects assessment of Section 20.3.10 includes the small amount of loss that would occur during operations. Effects during operations have not been assessed separately from those during construction.

20.3.13 Mitigation Measures – Change in Food Production and Consumption

The effects assessment concluded that there would be no adverse effect on food self-reliance for the Peace Agricultural Region. However, the measures included in the regional compensation program discussed in Section 20.3.9 could support increased food self-reliance.

Food self-reliance in the Peace Agricultural Region can be changed by creating opportunities to generate more agricultural products within the region from the remaining post-project farmland. Strategies that can increase the food production capacity of the region are those outlined in Section 20.3.9 and include:

- Raising the productivity of some remaining land through irrigation improvements and infrastructure
- Increasing potential crop yields by investing in varietal trials and new crop research on plants adapted to climate change
- Assisting in the development of the 45% of the ALR in the Peace Agricultural Region that has not yet come into production (ALC 1998)
- Supporting initiatives within the Peace Agricultural Region to increase value-added food production in the livestock and cereal sectors
- Supporting initiatives within the Peace Agricultural Region to attract under-represented food sectors such as dairy, poultry meat, and eggs

However, increasing production of crops to increase food self-reliance in commodities where self-reliance is currently low may not always be in the best economic interests of producers and care should be taken to ensure support is provided only when returns justify the costs of production.

20.4 Summary of Effects Assessment and Mitigation Measures

This assessment evaluated four potential effects to the agriculture VC:

- Loss of agricultural land
- Effects to individual farm operations
- Changes to agricultural economies
- Changes to local food production and consumption

20.4.1 Effects and Mitigation Measures

The permanent loss of agricultural land is a residual effect after taking into consideration proposed mitigation measures, since the lost land cannot be replaced. 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. However, it remains that the loss of existing farm land as well as other lands with agricultural capability results in a permanent reduction in the agricultural land base of the region and the province.

Temporary loss of land and soil disturbance will be mitigated through implementation of management plans, such as Farm Mitigation Plans for individual farms and the Project Soil Management, Site Restoration, and Revegetation Plan as described in Volume 5 Section 35 Summary of Proposed Environmental Management Plans.

For each directly affected farm operation, a farm-specific analysis will be conducted and a Farm Mitigation Plan developed in consultation with the owner and or operator. These plans will describe appropriate mitigation measures to address specific on-farm effects for each farm operation. Agricultural land that is required for the Project will be acquired and associated financial losses (if any) will be reimbursed. Refer to Volume 2 Section 11.3 Land Status, Tenure, and Project Requirements for additional information. Farm-specific analysis would consider potential effects due to wildlife damage; changes to crop drying conditions, groundwater elevations, and crop production; unauthorized public access to farm properties; and livestock access to the reservoir, as described above in mitigation for farm operation activities, Section 20.3.7.2.

The permanent loss of land would result in a reduction in agricultural economic activity within the Peace Agricultural Region. BC Hydro's proposed compensation fund, if implemented efficiently, will mitigate this effect. The design and amount of the fund will be structured to mitigate the adverse effects on agricultural economic activity.

There are no residual effects to the ability of the region to be food self-reliant in commodities that can be produced in the region, as there is sufficient land remaining for the region to be self-sufficient in these commodities.

A summary of potential effects and mitigation measures for the agriculture VC are summarized in Table 20.37.

Table 20.37 Project Effects and Mitigation Measures for Agriculture

Project Phase	Potential Effects	Mitigation Measures	Mitigation Effectiveness	Responsibility
Construction	Loss of agricultural land	For temporary loss of agricultural land, implement the following Environmental Management Plans: ▪ Soil Management, Site Restoration and Revegetation Plans ▪ Borrow and Quarry Site Reclamation Plans ▪ Vegetation and Invasive Plant Management Plan For permanent loss of agricultural land: ▪ Agricultural compensation fund to support projects, such as irrigation and drainage improvements ▪ ~~Irrigation improvements~~ ▪ ~~Drainage improvements~~ ▪ Relocation of suitable quality soil in selected locations ▪ Inclusion of land in the Agricultural Land Reserve based on discussion with the ALC, Crown and private landowners ▪ ~~Agricultural compensation fund~~	These mitigation measures for the temporary loss of agricultural land are expected to be effective, as they are common approaches to temporary disturbance during construction projects A residual adverse effect is expected for the permanent loss of agricultural land. The mitigation measures could improve productivity on remaining and replace the productivity of the lost lands, but the lost land itself cannot be replaced.	BC Hydro and their contractors in developing and implementing the Soil Management, Site Restoration and Revegetation Plans Borrow and Quarry Site Reclamation Plans and Vegetation and Invasive Plant Management Plan Management of the agricultural compensation fund in evaluating and funding irrigation and drainage improvements and in evaluating and funding other opportunities to increase production on remaining lands BC Hydro in investigation of opportunities for the relocation of suitable quality soils and inclusion of land in the Agricultural Land Reserve
Operations	Loss of agricultural land	As noted for Construction – Loss of agricultural land	As noted for Construction – Loss of agricultural land	As noted for Construction – Loss of agricultural land

Project Phase	Potential Effects	Mitigation Measures	Mitigation Effectiveness	Responsibility
Construction	Effects on individual farm operations	▪ Acquisition of land required for the Project ▪ Reimbursement of associated financial losses ▪ Farm Mitigation Plans: o Environmental Management Plans including: o Soil Management, Site Restoration and Revegetation Plans o Vegetation and Invasive Plant Management Plan o Traffic Management Plans o Public Safety Management Plan o Biosecurity protocols if required	Mitigation measures are expected to be effective, as they are common approaches to mitigating effects to individual farm operations	BC Hydro in acquiring land required for the Project and in providing reimbursement of associated financial losses BC Hydro and their contractors in developing and implementing the Farm Mitigation Plans and Environmental Management Plans Soil Management, Site Restoration and Revegetation Plans Borrow and Quarry Site Reclamation Plans and Vegetation and Invasive Plant Management Plan
Operations	Effects on individual farm operations	Evaluate the following potential effects, and where appropriate enter into agreements with affected landowners: ▪ 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 water-based access ▪ Livestock damage due to new access to the reservoir	Mitigation measures are expected to be effective in addressing adverse effects encountered during operations	BC Hydro in evaluating the potential effects and entering into agreements with affected landowners where appropriate

Project Phase	Potential Effects	Mitigation Measures	Mitigation Effectiveness	Responsibility
Construction and Operations	Change to agricultural economic activity	Agricultural compensation fund	An effectively designed, financed and managed agricultural compensation fund will mitigate effects to agricultural economic activity	BC Hydro in leading the consultation with agricultural organizations, the Agricultural Land Commission, the B.C. Ministry of Agriculture and other relevant agencies and the agricultural community to determine the amount and design of the fund. The fund management in evaluating funding opportunities, allocating funding and monitoring the effectiveness of funded projects
Construction and Operations	Change to regional food production and consumption	No mitigation required	N/A	N/A

NOTE:
N/A – not applicable

20.4.2 Other Mitigation Options Considered

Large-scale relocation of suitable quality soil was also considered; however, this mitigation strategy would be constrained by:

- Concerns over disturbance to archaeological sites
- Erosion of disturbed areas during reservoir filling
- Weed control
- Habitat degradation

These constraints are not technically and economically feasible options for mitigation. At a site-specific level, topsoil may be relocated as part of site reclamation activities in a localized area, subject to consideration of environmental effects.

20.5 Residual Effects

This section describes the characterization of residual effects, thresholds for determining significance, and the determination of significant effects.

20.5.1 Characterization of Residual Effects

The 2,601 ha of Class 1 and 2 lands that would be permanently lost represent:

- 24.8% of the Peace River valley Class 1 and 2 land
- 2.1% of the Peace Agricultural Region Class 1 and 2 land
- 1.0% of the Provincial Class 1 and 2

The 3,433 ha of Class 1 through 3 lands that would be permanently lost represent:

- 20.6% of the Peace River valley Class 1 through 3 land
- 0.7% of the Peace Agricultural Region Class 1 through 3 land
- 0.4% of the Provincial Class 1 through 3 land

Of the land which would be lost, approximately 1,666 ha were identified as having high or moderate utility, 1,299 ha of high utility and 367 ha of moderate utility. Of the remaining lands within the Peace River valley, 12,527 ha were identified as having high or moderate utility, including 9,778 ha of high utility lands and 2,749 ha of moderate utility lands. Within the Peace River valley, the permanently lost land would represent:

- 11.7% of the total of 11,077 ha with high utility
- 11.8% of the total of 3,116 ha with moderate utility
- 11.7% of the total of 14,193 ha with high or moderate utility

In the absence of mitigation measures, this permanent loss of land would result in an overall reduction in future agricultural production and associated economic activity. 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.

Residual effects were characterized based on the characteristics described in Table 20.38.

Table 20.38 Characterization Criteria for Residual Agricultural Effects

Criterion	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The ultimate long-term trend of the effect (increase, decrease or neutral).	**Adverse:** condition of the VC is worsening in comparison to baseline conditions and trends
		Positive: condition of the VC is improving in comparison to baseline conditions and trends
		Neutral: condition of the VC is unchanged in comparison to baseline conditions and trends
Magnitude	The amount of change in a key indicator or variable relative to the baseline case (low, moderate, high), consideration is given to factors such as the uniqueness of the effect, and the comparison to natural or background variation.	**Negligible:** no detectable or measurable effect
		Low: effect is detectable but is within the normal variability of baseline conditions
		Moderate: potential changes in the agricultural land base or agricultural economic activity are between 0.5 and 1.0% of baseline conditions
		High: potential changes in the agricultural land base or agricultural economic activity are greater than 1.0% of baseline conditions
Geographical Extent	The geographic area in which an effect of a defined magnitude occurs (site-specific, local, regional, provincial, national, international)	**Site-specific:** the effect is within the Project activity zone
		Local: the effect is within the Peace River valley
		Regional: the effect is within the Peace River Agricultural Region
Frequency	The number of times during a project or a specific project phase that an effect may occur (once, daily, weekly, monthly, continuous.).	**Once:** effect occurs once
		Continuous: effect occurs at all times
		Sporadic: occurs rarely and at irregular intervals
Duration	Period of time until the valued component returns to its baseline condition, or the effect can no longer be measured or otherwise perceived (short term, medium term, long term, permanent).	**Short term:** effect is limited to <1 year
		Medium term: effect is limited to <10 years
		Long term: effect lasts throughout the life of the Project
		Permanent: effect occurs in perpetuity
Reversibility	The degree or likelihood to which existing baseline conditions can be regained after the factors causing the effect are removed.	Effect **reversible** with reclamation and compensation or over time
		Effect **irreversible** and cannot be reversed with reclamation or compensation or over time
Context	The extent to which the area within which an effect may occur; has already been adversely affected by human activities; and is ecologically fragile and has little resilience and resistance to imposed stressed	**Low:** low capacity for agriculture to accept change
		Moderate: moderate capacity for agriculture to accept change
		High: high capacity for agriculture to accept change

Criterion	Description	Quantitative Measure or Definition of Qualitative Categories
Level of Confidence	An evaluation of the scientific certainty one has in the review of project-specific data, relevant literature, and professional opinion. This includes the level of confidence in the assessment of direction, magnitude, duration, frequency and reversibility.	**Low:** assessment is based on professional judgment and experience but is hampered by incomplete understanding of cause-effect relationships and or lack of data
		Moderate: assessment is based on professional judgment and experience including a reasonable understanding of cause-effect relationships and reasonable data
		High: assessment is based on professional judgment and experience including a good understanding of cause-effect relationships and adequate data
Probability	The likelihood that an adverse effect will occur (e.g., low, high, unknown).	**Low:** likelihood of occurrence is low
		High: likelihood of occurrence is high
		Unknown: likelihood of occurrence is unknown

Characterization of potential adverse effects on the agricultural land base is shown in Table 20.39.

Table 20.39 Characterization of Residual Agriculture Effects

Activity	Effect	Residual Environmental Effect							
		Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Social Context	Level of Confidence	Probability
Construction	Permanent loss of agricultural land	Adverse	High	Site-specific	Permanent Continuous	Irreversible	Moderate	High	High

As almost all adverse effects result from permanent land loss occur during construction, the characterization of these effects has not been repeated for the operational phase of the Project.

20.5.2 Standards or Thresholds for Determining Significance

There are no recognized government or industry guidelines or objectives for determining significance of effects to agriculture. A residual effect is considered significant if all of the following criteria are met:

- The effect is adverse
- The magnitude is moderate or high
- The duration is long term or permanent
- The frequency is continuous
- The effect is irreversible
- There is a low capacity for agriculture to accept change

20.5.3 Determination of Significance of 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.

Table 20.40 summarizes the assessment of potential significant residual adverse effects on the agriculture VC.

Table 20.40 Summary of Assessment of Potential Significant Residual Adverse Effects on Agriculture

Valued Component	Project Phase	Potential Effect	Key Mitigation Measures	Significance Analysis of Residual Effects
Agriculture	Construction	Permanent loss of agricultural land	Agricultural compensation fund	Not significant

20.6 Cumulative Effects Assessment

A cumulative effect for agriculture would occur if there are adverse residual effects on agriculture that have spatial and temporal overlaps with residual effects of other current or reasonably foreseeable projects or activities.

Other projects that were screened in the assessment of cumulative effects to agriculture are summarized in Table 20.41. A full project inclusion list is included in Volume 2 Section 10 Effects Assessment Methodology.

Table 20.41 Projects that Could Interact with Agriculture Residual Effects

Site C Clean Energy Project Residual Effect	Other Project	Description of Project	Potential Overlap with Site C	Potential Cumulative Effect Interaction with Agriculture
Permanent loss of agricultural land	All other reasonably foreseeable projects in the RAA	• Underground and surface mines • Pipelines • Waste management projects • Wind projects	There is no spatial overlap, as none of the projects are within the agricultural land LAA	No: not expected to contribute to adverse residual effects on agriculture in the agricultural land LAA, as there is no spatial overlap
	Land tenure	Applications for agricultural tenures	One agricultural tenure application is within the agricultural land LAA, and the area included in this application has been included in the assessment of grazing tenures in the agricultural assessment	No: the one tenure application that includes land within the agricultural land LAA has been considered in the agricultural assessment

The only project or activity that would overlap spatially with the agricultural land LAA is one application for an agricultural tenure for grazing. The area of this application has been included in the consideration of grazing tenures in the agricultural assessment.

The adverse effect related to the permanent loss of agricultural land does not have spatial and temporal overlaps with residual effects of any other current or reasonably foreseeable projects or activities and therefore no further assessment of cumulative effects related to agriculture was conducted.

20.7 Monitoring and Follow-up

The following monitoring and follow-up programs are 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 they do occur, these changes would be detectable in the years immediately following reservoir filling.

The monitoring program objectives would be to a) confirm if a Project change has occurred, and b) specify the adverse effect on agricultural operations, and c) determine appropriate mitigation measures where adverse effects have been identified. The following are proposed to be monitored, including collection of relevant farm operating information, for at least 5 years prior to reservoir filling, and up to 5 years monitoring after reservoir filling, for agricultural operations not already covered by an agreement with BC Hydro:

- Monitor Project-induced changes in wildlife habitat utilization in, and evaluate associated crop or feed storage damage, for agricultural operations within 5 km of the reservoir, to assess if there is an increase in wildlife 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 depredation.
- Monitor Project-induced changes to humidity within 3~~1~~ km of the reservoir, and evaluate 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.
- Monitor 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 will include field surveys and farm operator interviews.

The following monitoring program is proposed to support future decisions regarding irrigation improvements, in support of the projects that may be proposed under the agricultural compensation program:

- 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. Data collection will be undertaken before and in the early years after reservoir filling, and data will be reviewed as required for proposed irrigation projects.

Table 20.42 Follow-up Program for Agriculture

Valued Component	Project Phase	Monitoring Program Objective	Monitoring Program Frequency	Monitoring Program Duration
Agriculture Operations		For reservoir-adjacent agricultural operations where there is not already an agreement with BC Hydro, monitor specific environmental factors, and evaluate associated potential effects, on: • 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 water based access~~ • ~~Livestock damage due to new access to the reservoir~~	Annual	First 5 years of operations
		Monitor climatic factors relevant to future irrigation improvement decisions that may be proposed under the agricultural compensation fund.	Annual	First 5 years of operations

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