27 VISUAL RESOURCES

27.1 Approach

As the Project would introduce permanent, visible features to the landscape, visual resources would be affected within and around the Project activity zone. The key indicators for this effect are the visibility of Project components from selected receptor sites and predicted scenic values. Receptor sites are locations specifically selected to assess the Project effects from a large number of baseline viewpoints. The methods for compiling the baseline and undertaking the assessment are adapted from the Visual Landscape Inventory: Procedures and Standards Manual (B.C. Ministry of Forests, Lands and Natural Resource Operations 1997) and Visual Impact Assessment Guidebook (BCMOF 2001). The Visual Landscape Inventory, a comprehensive description of the visual landscape in B.C., is used as an input to formulate the baseline conditions. Geographic information system (GIS)-based visibility analysis and photomontages are used to assess the key indicators.

27.2 Regulatory and Policy Setting

The assessment was prepared in accordance with Section 16.9 of the Site C Clean Energy Project Environmental Impact Statement Guidelines (Minister of Environment of Canada and the Executive Director of the BCEAO 2012) (EIS Guidelines). A provincial policy for the management of visual resources in forestry exists pursuant to the *Forest and Range Practices Act*; however, there are no specific policies for other resources or projects.

27.2.1 Key Issues and Identification of Potential Effects

As described in the EIS Guidelines, there is the potential for adverse effects on visual resources due to changes in the following as a result of the Project:

- Visibility of Project components from selected receptor sites
- Predicted scenic values using photomontages and assessed according to the Visual Impact Assessment Guidebook (BCMOF 2001)

As described in Section 27.3, the above two potential effects are combined into the assessment of potential effects on visual resources.

There is the potential for adverse effects on visual resources, since construction of the Site C dam site, construction of the transmission line, Highway 29 realignment, clearing of vegetation, construction of Hudson's Hope shoreline protection, filling of the Site C reservoir, construction of access roads, and construction of worker accommodations are anthropogenic disturbances, and would alter the viewscapes from receptor sites in and around the Peace River valley.

Issues, concerns, and interests identified during consultation with the public, Aboriginal groups, and government agencies guided the scope of the visual resources assessment (see Volume 1 Section 9 Information Distribution and Consultation). The key issues identified and the approaches used to address issues are outlined in Table 27.1.

Table 27.1 Key Issues: Visual Resources

Key Issues	Approach to Addressing Key Issues
General visual impacts and changes to aesthetics	Photomontages were prepared to communicate altered views and river landscape A visibility analysis was conducted to show where the Project would be visible from Effects on visual resources were assessed
Loss of river landscape, including islands	Photomontages were prepared to communicate altered views and river landscape after the filling of the Site C reservoir
Vegetation removal on river islands	Photomontages were prepared to communicate altered views during and after vegetation removal
Loss of scenic view opportunities	Receptor sites were selected at scenic view locations
Loss of visual cultural referents in the form of the visual landscape	Photomontages were prepared to communicate altered views and river landscape A visibility analysis was conducted to show where the Project would be visible from

Potential Project interactions with VCs are summarized in Volume 2 Appendix A Project Interactions Matrix, Table 2. As defined in Volume 2 Section 10 Effects Assessment Methodology, a “2” ranking is assigned where an interaction may result in an adverse effect and the nature of the effect and/or the effectiveness of mitigation measures is uncertain. These interactions were taken forward through the effects assessment.

Project interactions with a ranking of “2 are set out in Table 27.2.

Table 27.2 Interactions of the Project with Visual Resources

Project Activities and Physical Works	Key Aspects
	Changes in Visual Resources
Construction	
Dam and Generating Station	✓
Reservoir Preparation and Filling	✓
Transmission System	✓
Quarried and Excavated Material Source Development	✓
Highway 29 Realignment	✓
Construction Access Road Development	✓
Worker Accommodation	✓
Operations	
Reservoir and Generating Station	✓

NOTE:
A ✓ indicates that an activity is likely to contribute to the effect

27.2.2 Standard Mitigation Measures and Effects Addressed

A “1” ranking was given where an adverse effect may result from an interaction, but standard mitigation measures to avoid or minimize the potential effects are available and well understood to be effective, and any residual effect is negligible. There are no standard mitigation measures for visual resources and therefore no “1” rankings were

given. All Project activities listed in Table 27.2 are carried through to the effects assessment.

All other Project activities and works listed in Table 2 of Volume 2 Appendix A Project Interaction Matrix were ranked as “0” because the activities do not interact with visual resources, or “n/a” if the interaction is more appropriately evaluated at the Project component level.

27.2.3 Selection of Key Indicators

The predicted visibility of the Project components at receptor sites and the predicted scenic values were selected as key indicators. Figure 27.3 shows the five receptor sites that were selected as representative of the visual landscape in the Peace River valley. Photographs from the receptor sites showing the river valley and its southern slopes are included in Figures 27.4 to 27.8. Information regarding baseline scenic values was acquired from the Visual Landscape Inventory (B.C. Ministry of Forests, Lands and Natural Resource Operations 2012a). A list of key indicators, including the rationale for selection, is provided in Table 27.3.

Table 27.3 Key Indicators for Visual Resources

Key Aspects	Key Indicators	Rationale for Selection of the Key Indicators
Changes in visual resources	Representative visual receptor sites, considering provincial Visual Landscape Inventory sites, and sites identified during field reconnaissance, that offer views of the proposed Site C reservoir and dam site	Visual resources and public viewpoints as identified may be affected where Project components are visible
	Public viewpoint of the river from Hudson’s Hope, and from near the proposed Site C dam site	

27.2.4 Spatial and Temporal Boundaries

27.2.4.1 Spatial Boundaries

The Local Assessment Area (LAA) in the EIS Guidelines for the assessment of the VC of visual resources is the Site C reservoir and dam site as viewable from Visual Landscape Inventory viewpoints. The Regional Assessment Area (RAA) in the EIS Guidelines is the Visual Landscape Inventory viewpoints within or adjacent to the Project activity zone.

The area used for reporting in this assessment was updated from the spatial boundaries in the EIS Guidelines. The spatial boundaries for the assessment of Project effects on visual resources were determined and defined by the:

- Project description (dimensions)
- Natural characteristics of the VC

The dimensions of the built structures at the proposed Site C dam site were selected as a reference to determine the size of the LAA. The Site C dam site contains the largest features that would be immediately recognizable as anthropogenic additions to the landscape. Based on the dimensions of these features, it was determined that, at a

distance of 8 km, the largest Project components would be predicted to appear small enough to present a negligible effect on visual resources, even under optimal viewing conditions. The LAA is therefore defined as the Site C reservoir, Site C dam site, and transmission corridor (Project components that would contain the largest or tallest visible features) plus an 8 km buffer, as well as the sites for quarried and excavated materials and worker accommodation (Project components that would contain smaller features), plus a 1 km buffer. The LAA used in this assessment includes the area defined in the EIS Guidelines, but is larger and therefore more conservative.

The RAA is identical in extent to the LAA defined above, including Visual Landscape Inventory viewpoints within or adjacent to the Project activity zone.

The LAA and RAA are shown in Figure 27.1 and summarized in Table 27.4.

Table 27.4 Spatial Assessment Areas for Visual Resources

Local Assessment Area	Regional Assessment Area
Site C reservoir, Site C dam site, and transmission corridor, plus an 8 km buffer as well as the sites for quarried and excavated materials and worker accommodation, plus a 1 km buffer.	LAA and Visual Landscape Inventory viewpoints within or adjacent to the Project activity zone.

27.2.4.2 Temporal Boundaries

The visual resources assessment assessed potential Project effects during the construction and operational phases of the Project. The Project's effects on visual resources would begin during Site C dam construction and vegetation clearing, and would continue during Site C reservoir filling (Years 1 to 8) and throughout Site C reservoir and dam operations (Year 8 through the life of the Project).

27.3 Information Sources and Methodology

The methods for compiling the baseline and undertaking the assessment are adapted from the B.C. Ministry of Forests, Lands and Natural Resource Operations manuals and guidelines. Methods are summarized below and detailed in the following sections.

To formulate the baseline, Visually Sensitive Areas and baseline viewpoints in the LAA were identified from the Visual Landscape Inventory. Visually Sensitive Areas are areas of specific concern for visual resources with established ratings for Existing Visual Conditions. Photographs taken from baseline viewpoints serve as an inventory of the existing landscape in the LAA. Additional baseline viewpoints were added where a potential line of sight existed to the Project. Geo-referenced photos were collected from the baseline viewpoints. The description of baseline conditions included, among other features of the visible landscape, the level of existing visual disturbances in the LAA.

To assess the key indicators, five receptor sites were selected from the baseline viewpoints (see Figure 27.3). For these receptor sites, a GIS-based visibility analysis was conducted and photomontages of the Project were created, taking into account the dimensions of the Project components and the topography of the existing landscape (see Figures 27.4 to 27.8). With input from these photomontages (where possible), changes in scenic values were assessed based on whether the management objectives of the Visually Sensitive Areas (Established Visual Quality Objectives) into which the

Project components would fall were met, and whether the introduced anthropogenic disturbances would exceed existing levels of disturbances in the LAA.

27.3.1 Literature Review

The following information on visual resources was used to support the formulation of the baseline, and to assist with assessing effects:

- Project description and Project-related information (BC Hydro 2012a, 2012b)
- Provincial Visual Landscape Inventory, which constitutes a comprehensive baseline assessment of the visual landscape in the Peace River valley
- Peace River Site C Hydro-Electric Development Recreation Impact Assessment (Edwin, Reid & Associates 1979)

The Visual Landscape Inventory includes information on the conditions, characteristics, and sensitivity of the visual landscape in B.C., and provides information on scenic values for this assessment. Specifically, the Visual Landscape Inventory delineates Visually Sensitive Areas, defined as areas where changes to the visual landscape could potentially give rise to stakeholder concerns. Among other criteria, the Visual Landscape Inventory provides ratings for Existing Visual Conditions for ~~each~~ Visually Sensitive Areas that were mapped in the field. The Existing Visual Conditions rating is a measure of how much an area has been altered by visible anthropogenic disturbances. The ratings are classified into six levels of landscape alteration, based on the scale of disturbance and compatibility of the disturbance with natural conditions (see Table 27.5).

Table 27.5 Visual Landscape Inventory Existing Visual Conditions Ratings

Existing Visual Conditions	Description
Preserved	No visible anthropogenic disturbances
Retained	Anthropogenic disturbances are not visually evident
Partially Retained	Anthropogenic disturbances are visible, but remain subordinate
Modified	Anthropogenic disturbances are visually dominant, but have characteristics that appear natural
Maximally Modified	Anthropogenic disturbances are dominant and out of scale, but appear natural in the background
Excessively Modified	Anthropogenic disturbances are excessive and greatly out of scale

NOTE:
Source: BCMOF (1997)

In addition to providing a general description of the visual landscape, the Existing Visual Conditions rating in the Visually Sensitive Areas serves as an input to the baseline description of the existing landscape for this assessment. The Visual Landscape Inventory was obtained from the Recreation Resources Inventory Online BC (B.C. Ministry of Forests, Lands and Natural Resource Operations 2012a) on June 1, 2012.

The Peace River Site C Hydro-Electric Development Recreation Impact Assessment (Edwin, Reid & Associates 1979) provided information on what locations and viewpoints had previously been regarded as important for visual resources.

27.3.2 Field Investigations

A site visit was conducted on May 15, 2012 to collect photographs of the existing landscape from baseline viewpoints. Baseline viewpoints for this study were selected from viewpoints previously defined in the Visual Landscape Inventory, along with other locations with views of the Peace River valley that were readily accessible to the public. According to the Visual Landscape Inventory, there are eight major viewpoints and 27 minor viewpoints within the LAA. Major viewpoints are defined as locations with a higher number and frequency of visitors, longer duration of viewing, and easier access (BCMOF 1997). Examples in the LAA are highway pullouts or viewpoints. Four major viewpoints were predicted to have a line of sight to the proposed Site C reservoir. A number of minor viewpoints are located either on the Peace River or within the extent of the proposed Site C reservoir and would be submerged by the Site C reservoir. Of the remaining minor viewpoints, five are predicted to have a line of sight to the Project. Based on line of sight, four major and five minor viewpoints from the Visual Landscape Inventory were identified as baseline viewpoints for this study, and were visited during the photo survey. These sites also include the viewpoints used in the 1979 recreation impact assessment (Edwin, Reid & Associates 1979). In addition, three more baseline viewpoints with views of the Peace River valley were added. These baseline viewpoints are located at the south end of 100th Street in Fort St. John, at the community of Old Fort on Old Hope Road along Highway 29, and at a viewpoint above Hudson's Hope.

One or more photographs at the location of every baseline viewpoint were taken in the direction of the proposed Project (Site C dam site or reservoir), with a combined field of view large enough to show all visible Project components predicted to be visible (see Figures 27.4 to 27.8). The details of the photographs (e.g., location, bearing, focal length, time, and date) were recorded in the field to allow for an accurate representation of the photo geometry when modelling the Project components. Details of reference objects (landscape features such as trees, or objects added to the view such as flags) were also recorded to allow for the verification of camera geometry details (e.g., bearing and tilt). For each baseline viewpoint, the photos covered the complete Project activity zone (BC Hydro 2012), as visible from the baseline viewpoint, in a panoramic image. Baseline viewpoint site information is summarized in Table 27.6. Baseline viewpoints are ~~also~~ shown in Figure 27.2, while the visual landscape inventory viewpoints are shown in Figure 27.2.1.

Table 27.6 Baseline Viewpoints

Baseline Viewpoint	Location	VLI [a] Viewpoint Type	Easting	Northing
1	Fort St. John, End of 100th Street	N/A	633552.5	6231419.5
2	Old Fort	Major	634837.2	6230991.3
3	Old Hope Road	N/A	621933.5	6235825.9
4	Highway 29, overlooking Bear Flat	Minor	609732.4	6239206.8
5	Highway 29, overlooking Attachie	Major	598972.8	6233907.4
6	Highway 29, 5 km west of Attachie	Minor	591826.4	6228535.3
7	Highway 29, 8 km west of Attachie	Minor	589174.6	6227318.5
8	Highway 29, east of Farrell Creek	Minor	586559.3	6224175.3
9	Highway 29, west of Farrell Creek Bridge	Minor	575181.8	6219510.8
10	Hudson's Hope, Canyon Drive	Major	566285.2	6209341.0
11	Highway 29, south of Hudson's Hope	N/A	565071.8	6203757.5
12	Hudson's Hope, Peace Canyon Road	Major	563000.1	6205142.8

NOTE:
[a] VLI – Visual Landscape Inventory: Procedures and Standards Manual (BCMOF 1997)

27.3.3 Baseline Methodology

A GIS-based visibility analysis was conducted to determine which potential receptor sites and areas in the LAA would have a line of sight to the Project. Separate analyses were conducted for the Site C dam site, the Site C reservoir, and the transmission line. The visibility analysis used Digital Terrain Models or Digital Surface Models to calculate potential lines of sight. A 1 m resolution full feature Light Detection and Ranging Digital Surface Model was used for the Peace River valley, and a 20 m resolution Digital Terrain Model (NTDB 2012) was used for the remainder of the LAA. Digital Surface Models allow for the calculation of a Zone of Visual Influence, while Digital Terrain Models result in a Zone of Theoretical Visibility.

The Zone of Visual Influence is the area from which the Project components are predicted to be visible based on the analysis of a Digital Surface Model. A Digital Surface Model includes topography, as well as all natural and anthropogenic structures, and can therefore be used, together with Project components modelled in three dimensions, to predict visibility. Grid-based Digital Surface Models derived from Light Detection and Ranging full-feature data with a standard resolution and accuracy (1 m grid cell resolution and 0.25 m vertical accuracy) have been found to predict visibility with more than 90% accuracy (Berry 2004).

While allowing for a relatively accurate prediction of visibility from the surface, Zone of Visual Influence analysis based on Digital Surface Models alone tends to overestimate the area in which potential receptors may be affected by a project, since the results include surface areas such as building roofs and tree canopies that are not generally accessible. Thus, the analysis might predict a Project to be visible from the top of the tree canopies of a forest, but observers standing on the ground would find their views blocked by the trees. To account for these overestimations, areas of the Digital Surface Model with structures of sufficient height to block the lines of sight of an observer located within these structures are removed from the Zone of Visual Influence.

In some cases, natural and anthropogenic structures on the topography that are included might not actually block lines of sight. Examples include single trees or small clumps of trees that allow for lines of sight under or through their canopies. In such cases, the analysis has the potential to underestimate visibility.

The Zone of Theoretical Visibility is the area from which the Project components may theoretically be visible. The Zone of Theoretical Visibility is derived by taking into account the screening afforded by landforms and major vegetated areas. Using a Digital Terrain Model representing the topography of the area, Project components modelled in three dimensions and the heights of major vegetated areas are used as input. Vegetation heights were obtained from the Vegetation Resources Inventory (B.C. Ministry of Forests, Lands and Natural Resource Operations 2012b). The results represent a worst-case scenario, depicting a bare ground situation that takes into account only major visual barriers created by landforms or major vegetated areas.

Zone of Theoretical Visibility analysis tends to overestimate visibility for a different reason than that estimated by Zone of Visual Influence analysis. In reality, considerable screening at eye level is afforded by additional intervening vegetation, buildings, and structures, particularly those adjacent to the Project site and to potential receptors. For areas with little vegetation and few built structures, visibility overestimation is low. For more complex landscapes, the Zone of Theoretical Visibility analysis has been found to overestimate visibility by up to 50% (Berry 2004). The accuracy of the Zone of Theoretical Visibility analysis is influenced by the accuracy and resolution of the input Digital Terrain Model as well as the GIS algorithms used. The influence of Digital Terrain Model accuracy on the accuracy of the analysis results is considered to be larger than the influence of resolution (Dodd 2001; Riggs and Dean 2007). For Digital Terrain Models of a resolution of 10 m or less, the influence of increased resolution on the accuracy of visibility prediction has been shown to be minimal (Kedzior 2007).

The results of the visibility analyses were used in the effects assessment to determine which parts of the LAA are predicted to have a line of sight to the Project; these results are shown in Figure 27.3.

27.3.4 Effects Assessment Methodology

In order to assess Project effects on visual resources in consideration of all anthropogenic disturbances, the Visual Impact Assessment Guidebook (B.C. Ministry of Forests, Lands and Natural Resource Operations 2001) was used as a framework, and the methodology was update to suit the Project as the Guidebook was written to address visual impacts of forestry activities only. To determine the effect on visual resources two key indicators, the changes in visibility from receptor sites and changes to scenic values, were assessed. To support the assessment of changes to scenic values, additional visual disturbances introduced by the Project to Visually Sensitive Areas (where the Project falls within such areas) were considered. Specifically, the total amount of anthropogenic visible Project disturbances in the affected Visually Sensitive Areas, including both baseline disturbances (recorded in the Existing Visual Conditions) and Project disturbances, were compared against the established visual quality objectives.

The visual quality objectives established by the Visual Landscape Inventory represent a management goal against which potential changes to the visual landscape are measured. One of five established visual quality objectives (EVQO) is assigned to every Visually Sensitive Area (the established visual quality objectives rating corresponds to

the first five levels of the Existing Visual Conditions rating). For every established visual quality objectives rating, an acceptable level of visual disturbances is defined. Where this level of disturbance is not exceeded, the management goal is considered to be reached. Table 27.7 lists the established visual quality objectives and the associated amount of acceptable disturbance.

Table 27.7 Established Visual Quality Objectives (EVQO) Rating and Acceptable Disturbance

EVQO	Description
Preservation	Consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is very small in scale, and not easily distinguishable from the pre-change landscape.~~No visible anthropogenic disturbances~~
Retention	Consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is difficult to see, small in scale, and natural in appearance.~~Anthropogenic disturbances, if visible, are difficult to perceive~~
Partial Retention	Consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is easy to see, small to medium in scale, and natural and not rectilinear or geometric in shape.~~Anthropogenic disturbances may be visible, but do not dominate~~
Modification	Consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is very easy to see, and is large in scale and natural in its appearance, or small to medium in scale but with some angular characteristics.~~Anthropogenic disturbances may be visible and may dominate in the short term~~
Maximum Modification	Consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is very easy to see, and is very large in scale, rectilinear and geometric in shape, or both.~~Anthropogenic disturbances may dominate~~

NOTE:
Source: Forest and Range Practices Act, Forest Planning and Practices Regulation, October 4, 2010~~BCMOF 2001~~

Among the baseline viewpoints (see Section 27.3.2) that would have a line of sight to Project components, receptor sites for the effects assessment were selected. The receptor sites include representative views of the baseline landscape (including Visually Sensitive Areas), as well as the Project components. Artist renderings based on photomontages of the Project were prepared for each receptor site. The renderings supported the subsequent assessment as to whether the established visual quality objectives for the affected Visually Sensitive Areas were met. Where receptor sites for affected Visually Sensitive Areas do not exist, the assessment was based on the Project description. Where Project components are located within a Visually Sensitive Area and the established visual quality objectives are not met, scenic value is considered to be lowered by the Project.

The results of the visibility analysis – including how much of the land in the LAA would have lines of sight to individual Project components and what receptor sites the Project would be visible from – were used as supporting criteria to determine the magnitude of effect on visual resources.

Artist renderings were based on photomontages, which are composite images that superimpose rendered Project components over photos taken in the field. The Project

components, which were modelled in a software called Visual Nature Studio, were based on the data provided by BC Hydro and included the Site C reservoir, areas likely to experience erosion, the realignment of Highway 29, and proposed bridges and causeways. The modelled and rendered Project components were superimposed over the photos and then artistically enhanced to look more realistic. Features blocking the view towards the Project (e.g., terrain or trees) were identified, reintroduced into the photo, and placed over the Project components. Panoramic images were created by combining several photomontages.

27.4 Baseline Conditions

The majority of the LAA is located within the boreal plains and reaches into the foothills of the Rocky Mountains in the southwest. Flat or gently undulating topography dominates large parts of the LAA. Prominent hills are found in the southwest, with Portage

Mountain (located 1 km west of the LAA) being one of the most noticeable topographical features (see Figure 27.2). The Rocky Mountains and foothills are increasingly visible as a backdrop west of the LAA. The valleys of the Peace River, Halfway River, Pine River, and various smaller creeks are cut into the plains. Within and on the edge of the valleys, slopes and steep bluffs dominate the views. Agricultural and urban uses determine the character of the landscape around Fort St. John and Charlie Lake. Open agricultural land and forested areas with fewer and smaller settlements are found on the plains north of the Peace River valley. On the plains south of the valley, the landscape is mainly dense forest.

The valley of the Peace River is approximately 3 km wide and, in most locations, situated approximately 60 m below the surrounding plain. The valley widens at the confluence with tributaries, including at Bear Flat and Attachie. Moderate to steep slopes form the sides of the valley. The southern slopes are almost entirely forested, with the exception of occasional rock outcrops and steeper eroded cliffs. The northern slopes are a mixture of wood and grasslands. Rock outcrops and cliffs are common. At the bottom of the valley, woodlands and agricultural lands can be found, with the latter covering most of the wider areas.

Highway 29 stretches along the Peace River within and above the valley. Smaller access roads and active farms are found throughout the valley. The town of Hudson's Hope is located in the river valley at the southwestern end of the LAA. Approximately 5.5 km southwest of the town, Highway 29 crosses the river on a suspension bridge. Peace Canyon Dam, a hydroelectric power plant and the reservoir created by the dam (Dinosaur Reservoir) are situated approximately 900 m upstream of the bridge. Transmission lines cross the Peace River between the Peace Canyon Dam and the Highway 29 suspension bridge.

The level of anthropogenic disturbance in the LAA reflects a landscape with multiple historically developed uses, including urban and industrial uses around Fort St. John; residential uses around Charlie Lake and Hudson's Hope; agricultural use; forestry, oil, and gas activity; and an existing hydroelectric plant and reservoir. Larger infrastructure features in the LAA include the Highway 97 and the North Peace Regional airport. There are numerous smaller access roads serving residences and agricultural land as well as forestry, oil, and gas activity.

Within the Visually Sensitive Areas, levels of disturbance vary. The Existing Visual Conditions range between "excessively modified" and "preserved", encompassing the full range of Existing Visual Conditions ratings. The ratings for the Visually Sensitive Areas on the southern slopes of the Peace River valley, with the exception of the area around the Highway 29 bridge southwest of Hudson's Hope, range between "retained" and "preserved".

Due to the character of the landscape in the LAA, the areas of higher scenic value are found within the river valleys. Accordingly, the Visual Landscape Inventory determines Visually Sensitive Areas ~~primarily~~ on the southern slopes of the Peace River valley, as seen from Highway 29 and the Peace River, and on the northern slopes as approximated from the Peace River. The Visual Landscape Inventory also defines the valleys of the ~~Halfway~~ Moberly River and Pine River as visually sensitive. Other smaller areas of sensitive landscape can be found on the slopes of the foothills southwest of Hudson's Hope, for example, on Portage Mountain.

The ratings for the ~~established visual quality objectives for the~~ Visually Sensitive Areas on the northern slopes of the Peace River valley ~~within the LAA generally~~ range between "modification" and "preservation". The ratings for the Visually Sensitive Area on the southern slopes of the Peace River valley range between "partial retention" and "preservation". Figure 27.3 shows the established visual quality objectives within the LAA. Figure 27.2 shows the Visually Sensitive Areas within the LAA and their Existing Visual Conditions.

Figure 27.3 shows the five receptor sites that were selected as representative of the visual landscape in the Peace River valley. Photographs from the receptor sites showing the river valley and its southern slopes are in Figures 27.4 to 27.8.

27.5 Effects Assessment

Potential effects on visual resources are assessed by taking into account the predicted changes to visual resources in consideration of:

- Visibility of Project components from selected receptor sites
- Predicted scenic values using photomontages and assessed according to the Visual Impact Assessment Guidebook (BCMOF 2001)

In the following sections, these key indicators are assessed together for each Project component for the construction and operation phases of the Project.

27.5.1 Construction Effects on Visual Resources

27.5.1.1 Site C Dam and Generating Station

The construction site, including facilities of various scales and types as well as modifications to landforms during construction, would be visible against the natural topography and vegetation of the Peace River valley. Assessment results indicate that the Site C dam would be visible from approximately 1,047 ha (area with a line of sight) within the LAA (Figure 27.3). This analysis takes into account the height of the Site C dam. Areas with a line of sight would be located on the south and north slopes of the Peace River valley approximately 10 km upstream and 10 km downstream from the Site C dam site. Agricultural lands and rural properties around Old Hope Road, approximately 10 km to the northwest of the Site C dam site, would also have a line of sight. The Site C dam would not be visible from the communities of Fort St. John, Charlie Lake, or Old Fort. However, other project components on the Site C dam site, such as access roads and the substation, may be visible from areas in Fort St. John and Old Fort.

There are no receptor sites that would have a line of sight to the Site C dam. However, if the site was viewed within the context of the Visually Sensitive Areas in the river valley, the visible disturbances due to construction of the Site C dam and generating station would be rated as acceptable for an established visual quality objective of "modification", since these disturbances would be easy to see and have some angular characteristics. ~~dominate the views in the short term.~~ The Visually Sensitive Areas on the slopes of the Peace River valley have established visual quality objectives higher (allowing for less disturbance) than "modification" (ranging between "partial retention" and "preservation"); therefore, the acceptable amount of disturbance (see definition in Table 27.7) would be exceeded. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect on visual resources.

27.5.1.2 Site C Reservoir Preparation – Vegetation Clearing

During the vegetation clearing for the Site C reservoir, portions of the Site C reservoir area (low-growing and non-merchantable vegetation) would remain largely undisturbed, and the outlines of the cuts would primarily follow the natural topography. However, the cleared areas would be noticeable as anthropogenic disturbances. Assessment results show that the cleared areas would be visible from approximately 7,618 ha (area with a line of sight) within the LAA (Figure 27.3). Areas with a line of sight would be located on the south and north slopes of the Peace River valley as well as on the slopes of the flooded tributaries of the Peace River. Other locations with a view of the cleared areas would include the open agricultural lands in Bear Flat and Attachie. Where Highway 29 overlooks the river valley, there would be lines of sight to the cleared areas. The Site C reservoir would not be visible from the communities of Fort St. John, Charlie Lake, or Old Fort, but it would be visible from Hudson's Hope.

The affected views would include receptor sites 1 to 5 along Highway 29 looking towards the southern slopes of the valley. Figure 27.4 to Figure 27.8 show the Site C reservoir during the construction phase as seen from these receptor sites.

The resulting visible disturbances from Site C reservoir clearing would be rated as acceptable for an established visual quality objective of "modification" for all receptor sites, since they would be easy to see and large, but natural in appearance.~~dominate the views in the short term.~~ Since the Visually Sensitive Areas on the southern slopes of the Peace River valley have established visual quality objectives higher than "modification" (ranging between "partial retention" and "preservation"), the acceptable amount of disturbance would be exceeded. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect on visual resources.

27.5.1.3 Site C Reservoir Preparation – Hudson's Hope Shoreline Protection

Hudson's Hope shoreline protection (see Volume 1 Section 4 Project Description), approximately 2.6 km long and 7 m wide, would be constructed along the Site C reservoir shoreline approximately 30 m below the community of Hudson's Hope. The construction would include shoreline preparation, including removal of vegetation from approximately 9 ha along the north bank of the Peace River. The Hudson's Hope shoreline protection would be noticeable as an anthropogenic modification to the existing natural landforms from the Site C reservoir, but would not be visible from Hudson's Hope. Because the Hudson's Hope shoreline protection would not be located in a Visually Sensitive Area and would not be visible from a receptor site, no Project effect on visual resources is predicted.

27.5.1.4 Site C Reservoir Filling

The Site C reservoir would replace the existing river, including a variety of islands and river channels, with a large homogenous water body. This effect could be considered either positive or negative by stakeholders, depending on the values placed on the existing river valley landscape. Figures 27.4 to 27.8 show the Site C reservoir as seen from receptor sites 1 to 5 in the early years of operation.

27.5.1.5 Transmission System

The commencement of construction of the transmission line will add visual features to the landscape. The transmission line would be visible from the Site C dam site on the

southern slopes of the Peace River valley and where it crosses the river immediately south of the Peace Canyon Dam. The transmission line would also be visible from Highway 29 where it crosses the right-of-way approximately 12 km southwest of Hudson's Hope.

For most of its length (approximately 90%), the transmission line would run through forested areas, with the trees blocking views of the transmission towers and conductors. The transmission line would pass through six Visually Sensitive Areas. Near the Site C dam site, it would be located in a Visually Sensitive Area with an established visual quality objective of "partial retention". It would also affect an area with an established visual quality objective of "modification" where it crosses the Moberly River valley, two Visually Sensitive Areas with an established visual quality objective of "partial retention", and one Visually Sensitive Area with an established visual quality objective of "retention" on the slopes of the Peace River valley south of Hudson's Hope. The visible disturbances due to transmission line construction would be rated as acceptable for an established visual quality objective of "partial retention" since the disturbances would be easy to see from some viewpoints, but would appear small to medium in scale.~~visible, but would not dominate the view of the Visually Sensitive Area.~~ The acceptable amount of disturbance would therefore be exceeded in at least one of the Visually Sensitive Areas. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect.

27.5.1.6 Highway 29 Realignment

The potentially affected views include the south and north slopes of the Peace River valley and the open agricultural lands adjacent to the realignments, as well as locations along Highway 29 looking down from high points towards Bear Flat and Attachie. These views are represented by receptor sites 1 and 2 (Figures 27.4 and 27.5).

The visible disturbances resulting from the Highway 29 realignment would be rated as acceptable for an established visual quality objective of "partial retention" for both receptor sites 1 and 2 since they would be visible, but would not dominate the views. The realignment would affect only two Visually Sensitive Areas on the north shore of the Peace River. One Visually Sensitive Area is located between Farrell Creek and Hudson's Hope with an established visual quality objective set to "modification". The other Visually Sensitive Area stretches from Farrell Creek east along the north shore of the Peace River to the Site C dam site and beyond. This Visually Sensitive Area has an established visual quality objective set to "preservation". The acceptable amount of disturbance would therefore be exceeded in at least one of the Visually Sensitive Areas. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect.

27.5.1.7 Quarried and Excavated Materials

Temporary riprap material required for Site C dam construction would be sourced from an existing quarry northeast of Fort St. John (Wuthrich Site), which would be expanded to accommodate Project needs. Permanent riprap is expected to be sourced from an existing quarry 75 km southwest of Chetwynd (West Pine Quarry), which would also be expanded. Till for the construction of the core of the earthfill Site C dam would be sourced from a site south of Fort St. John known as the 85th Avenue Industrial Lands. Construction materials would also be sourced from a site on the eastern slopes of Portage Mountain (Portage Mountain Quarry), a site west of the intersection of upper Jackfish Lake Road and the transmission right-of-way (Del Rio Pit) and, as required, on

the south side of the Peace River near Taylor (Area E). All sites would require clearing of vegetation, removal of material, and potentially stockpiling of excess material. Portage Mountain Quarry, West Pine Quarry, and Area E would be located within Visually Sensitive Areas. The resulting visible disturbances would be rated as acceptable for an established visual quality objective of "modification", since they would appear small to medium in scale and would have some angular characteristics. ~~could dominate the views in the short term.~~ Since the affected Visually Sensitive Areas have established visual quality objectives of ranging between "modification" and "partial retention", the acceptable amount of disturbance would be exceeded in at all sites. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect.

27.5.1.8 Construction Access Road Development

Existing roads on the north bank of the Peace River would be improved to provide access to the Site C dam and generating station. On the south bank, Jackfish Lake Road would be extended to the site along the Project access road. Temporary access roads would also be required for the construction of the transmission line, Site C reservoir preparation, and material source development.

The resulting visible disturbances from the construction of access roads would be rated as acceptable for an established visual quality objective of "partial retention" for all receptor sites since they would be easy to see from some viewpoint, but small to medium in scale. ~~visible, but would not dominate the views.~~ Since some of the affected Visually Sensitive Areas in the Peace River valley have established visual quality objectives higher (allowing for less disturbance) than "partial retention", the acceptable amount of disturbance would be exceeded. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect on visual resources.

27.5.1.9 Worker Accommodation

Potential effects of worker accommodation for the Site C dam site on visual quality are included in the assessment of the Site C dam and generating station (Section 27.5.1.1). Two other small-scale camps may be located in the LAA, the regional housing southern site in the vicinity of the upper Jackfish Lake Road area (north of Chetwynd) and the regional housing northern site in the vicinity of Hudson's Hope. Exact camp locations have not been determined; however, both sites would require clearing and grading, and may house RV spaces and prefabricated camp units. Because it is not known whether the regional worker accommodation would be located in a Visually Sensitive Area, it is not possible to determine visibility from a receptor site; therefore, a Project effect on visual resources cannot be predicted.

27.5.2 Effects of Operations on Visual Resources

27.5.2.1 Site C Dam and Generating Station

The Site C dam would have a visible gravel surface (matching the existing river gravel) on the downstream side and riprap on the upstream side. The buttress, spillway, and approach channel would have concrete surfaces. Other visible features would include access roads, and auxiliary and administrative buildings. In scale, texture, and shape, the Site C dam would stand out as a large industrial facility against the natural topography and vegetation of the Peace River valley. The completed Site C dam would

be visible from approximately 1,047 ha (area with a line of sight) within the LAA (Figure 27.3). Areas with a line of sight would include the south and north slopes of the Peace River valley approximately 10 km upstream and 5 km downstream from the Site C dam site. Agricultural lands and rural properties around Old Hope Road approximately 10 km to the northwest of the site would also have a line of sight. The Site C dam would not be visible from the communities of Fort St. John, Charlie Lake, or Old Fort. However, other project components on the Site C dam site, such as access roads and the substation, may be visible from areas in Fort St. John and Old Fort.

There are no known receptor sites that would have a line of sight to the Site C dam site. However, if the site was viewed within the context of the Visually Sensitive Areas in the river valley, the resulting visible disturbances would likely be rated as acceptable for an established visual quality objective of “maximum modification”, since these disturbances would be very easy to see, very large in scale and geometric in shape. ~~dominate the views.~~ Because the Visually Sensitive Area on the slopes of the Peace River valley have established visual quality objectives higher than “modification” (ranging between “partial retention” and “preservation”), the acceptable amount of disturbance would be regarded as exceeded. Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect of visual resources.

27.5.2.2 Site C Reservoir Operations

During Site C reservoir operations, erosion would be expected on the valley sides (Volume 2 Section 11.2 Geology, Terrain, and Soils), creating areas that could be perceived as anthropogenic disturbances. For the purpose of this assessment, it was assumed that not all areas within the erosion impact line (estimated erosion caused by the creation and operation of the reservoir over a period of 100 years) would appear eroded at the same time, as erosion progresses over time and some older eroded areas are successively revegetated. Furthermore, the natural context of the valley already shows visual evidence of progressive natural erosion.

Volume 2 Appendix B Geology, Terrain Stability, and Soil, Part 2 Preliminary Reservoir Impact Lines defines the 5-Year Beach Line as the predicted extent of shoreline retreat at the maximum normal reservoir level five years after impoundment of the Site C reservoir. This line is used to represent eroded areas after approximately five to 10 years of Site C reservoir operations, which has been described as the most active period of erosion after reservoir impoundment (see Figure 27.4 to Figure 27.8). While this scenario is included in the visual simulations to show erosion progression over time, for the purpose of this assessment, a scenario showing erosion within the erosion impact line is used (see Figure 1 to Figure 5 Reservoir Later Years of Operation in Volume 3 Appendix C Land and Resource Use Assessment Supporting Documentation, Part 6 Visual Resources Supporting Figures). Erosion disturbances within the erosion impact line would be expected to primarily occur within the Visually Sensitive Area on the southern slopes of the Peace River valley. The Site C reservoir and associated disturbances would be visible from approximately 7,618 ha within the LAA. Open areas (non-forested) on the slopes of the Peace River valley and on the slopes of the valleys of the flooded tributaries would have lines of sight to the Site C reservoir. Highway 29 would allow for expansive views of the Site C reservoir where it overlooks the valley. Views of the Site C reservoir outside the river valley would be limited to locations on the edge of the valley. The Site C reservoir would not be visible from the communities of

The affected views would primarily include receptor sites 1 to 5 along Highway 29 looking towards the southern slopes of the valley (Figures 27.4 to 27.8).

The visible disturbances as a result of Site C reservoir operations would occur mainly due to erosion; however, it is acknowledged that erosion is a natural process that currently affects the Peace River valley (see baseline Figures 27.4 to 27.8). These visual disturbances would be rated as acceptable for established visual quality objectives between “maximum modification” and “partial retention” depending on the erosion patterns and receptor sites. Disturbances would be visible from all receptors sites and would be very easy to see and very large in scale as seen from receptor sites 1 and 2. ~~dominate the views from receptor sites 1 and 2.~~ Since the Visually Sensitive Areas on the southern slopes of the Peace River valley have established visual quality objectives ranging between “partial retention” and “preservation”, the acceptable amount of disturbance would be exceeded for Visually Sensitive Areas with established visual quality objectives of “retention” or “preservation” seen from receptor sites 1 and 2 (around Bear Flat and Attachie). Due to this exceedance, scenic values are considered to be lowered, resulting in a predicted Project effect of visual resources.

27.5.3 Mitigation Measures for Effects on Visual Resources

BC Hydro will implement the following mitigation measures to address potential Project effects on visual resources. These mitigation measures will address visibility of Project features from selected receptor sites as well as changes to scenic values.

- Construction:
  - Disturbed areas (from construction of Site C dam, generating station, and Site C reservoir; Highway 29 realignment; transmission line; temporary access roads) will be restored in accordance with the Project Soil Management, Site Restoration, and Revegetation Plan (Volume 5 Section 35 Summary of Proposed Environmental Management Plans)
  - The design of the Hudson’s Hope shoreline protection will consider options visually compatible with the natural landscape by adding cover soil and vegetation to the sides and top of the berm
  - Permanent Site C dam site buildings and other above-ground structures will be painted to blend in with the character of the surrounding environment where possible (some equipment will have specific high-visibility colour schemes due to safety requirements)
  - Where feasible, previously disturbed areas, or areas generally hidden from view, will be selected for the potential off-site workforce accommodation camps

27.6 Summary of Effects Assessment and Mitigation Measures

With the application of the above mitigation measures, there would be residual effects (due to predicted lower scenic values and Project visibility from receptor sites) during Project construction and operations, as summarized in Table 27.8.

Table 27.8 Project Effects and Mitigation Measures on Visual Resources

Valued Component	Project Phase	Potential Effect	Mitigation Measures	Mitigation Effectiveness	Responsibility
Visual resources	Construction	Changes to visual resources	After disturbance activities cease, disturbed surfaces in construction areas will be restored and re-vegetated in accordance with the Project Soil Management, Site Restoration, and Revegetation Plan. The shoreline protection in Hudson's Hope will be naturally landscaped. Permanent Site C dam site buildings and other above-ground structures will be painted to blend in with the character of the surrounding environment where possible. Where feasible, previously disturbed areas, or areas generally hidden from view, will be selected for the potential off-site workforce accommodation camps.	The proposed measures are common in the mitigation of effects on visual resources and are likely to reduce (adverse) changes in scenic values. However, mitigation would be partial and residual effects would be expected.	BC Hydro and its contractors
	Operations	Changes to visual resources	None proposed	Residual effects would be expected.	N/A

NOTE:
N/A = not applicable

27.6.1 Other Mitigation Options Considered

There were no other mitigation measures considered by BC Hydro for effects on visual resources.

27.7 Residual Effects

27.7.1 Characterization of Residual Effects

The criteria to characterize residual effects to visual resources are described in Table 27.9.

Table 27.9 Characterization Criteria for Residual Visual Resources Effects

Criterion	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The ultimate long-term trend of the visual resource effects	**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 baseline case	**Low:** effect is such that the Project is visible from no receptor sites and scenic values are not lowered (i.e., acceptable amount of disturbance is not exceeded for any Visually Sensitive Area in the LAA)
		Moderate: effect is such that the Project is visible from receptor sites and scenic values are lowered (i.e., amount of acceptable visible disturbance is exceeded for one or more Visually Sensitive Areas), but the level of anthropogenic disturbance remains within the general (historical) level of existing visible disturbances in the LAA
		High: effect is such that the Project is visible from receptor sites and scenic values are lowered (i.e., amount of acceptable visible disturbance is exceeded for one or more Visually Sensitive Areas) and the level of anthropogenic disturbance exceeds the general (historical) level of existing visible disturbances in the LAA
Geographical Extent	The geographic area in which visual resource effects occur	**Site-Specific:** the expected measurable changes are localized to specific sites only
		Local: the expected measurable changes occur are within the LAA
Frequency	The number of times during a specific Project phase that visual resource effects may occur	**Once:** occurs once
		Continuous: occurs on a regular basis and at regular intervals
		Sporadic: occurs rarely and at irregular intervals
Duration	The period of time required until the valued component returns to its baseline condition, or the effect can no longer be measured or otherwise perceived	**Short-term:** effect is limited to <1 year
		Medium-term: effect occurs >1 year, but not beyond the construction of the Project
		Long-term: effect lasts beyond the construction phase and up to 10 years of the operations phase
		Far future: effect extends >10 years for the life of the Project
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/or over time
		Effect **irreversible** and cannot be reversed with reclamation and/or over time

Criterion	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological and Social Context	The extent to which the area within which an effect may occur has already been adversely affected by human activities	**Disturbed:** area has been previously disturbed by human development or human development is still present
		Undisturbed: area relatively pristine or not adversely affected by human activity
Level of Confidence	Scientific certainty one has in the review of project-specific data, relevant literature, and professional opinion	**Low:** assessment based on professional judgment and experience, but hampered by incomplete understanding of cause-effect relationships and or lack of data
		Moderate: assessment based on professional judgment and experience, including a reasonable understanding of cause-effect relationships and adequate data
		High: assessment based on professional judgment and experience, including a good understanding of cause-effect relationships and ample data
Probability	The likelihood that an adverse effect will occur	**Low:** effect is unlikely to occur
		High: effect is almost certain to occur
		Unknown: likelihood is unknown

The Project is predicted to be visible from receptor sites and to lower scenic values in some areas through an increase to the amount of visible anthropogenic disturbances in relation to base conditions during construction and operations. Change in the visible landscape from a river valley to a reservoir could be considered either a positive or negative change by stakeholders, depending on the values placed on the existing river valley landscape.

For the construction phase, the magnitude of effect (all Project components considered) is rated as moderate since the Project is predicted to be visible from receptor sites and scenic values are predicted to be lowered (i.e., visible disturbance would exceed the established visual quality objective for one or more Visually Sensitive Area), but the level of anthropogenic disturbances would not exceed the general (historical) level of visible disturbances in the LAA (see Section 27.4). The Peace River valley and the LAA have been exposed to a range of visible anthropogenic disturbances, including changes resulting from one other similar hydroelectric power plant (Peace Canyon Dam) and reservoir (Dinosaur Reservoir). The geographic extent of the effect is the LAA and therefore is considered local. The direction of the effect is considered adverse, as the level of anthropogenic disturbances is predicted to increase. The duration of effect would be medium term during construction. The effects would be irreversible, as the Site C reservoir, Site C dam site, Highway 29 realignment, and transmission line represent a permanent change to the visual landscape.

For the operations phase, the magnitude of effect (all Project components considered) is rated as moderate since the Project is predicted to be visible from receptor sites and scenic values are predicted to be lowered (i.e., visible disturbance would exceed the established visual quality objective for one or more Visually Sensitive Area), but the level of anthropogenic disturbances would not exceed the general (historical) level of visible disturbances in the LAA (see Section 27.4). The geographic extent of the effect is the LAA and therefore is considered local. The direction of the effect is considered adverse, as the level of anthropogenic disturbances is predicted to increase. The duration of

effect would be long term during operations. The effects would be irreversible, as the Site C reservoir and Site C dam site represent a permanent change to the visual landscape.

For both the construction and operations phases, the capacity of the visual landscape to accept change (context) is rated as disturbed, since a considerable amount of visible anthropogenic disturbance already exists within other parts of the LAA, including the Peace River valley (see Section 27.4 and Volume 1 Section 4 Project Description).

The degree of confidence in this assessment is moderate for the following reasons:

- Baseline landscape conditions are adequately characterized by the Visual Landscape Inventory: Procedures and Standards Manual (B.C. Ministry of Forests, Lands and Natural Resource Operations 1997) and the photo survey undertaken in May 2012
- Modelling processes, such as visibility analysis and representation of anticipated changes in the visible landscape through visual simulations, are well understood
- The B.C. Ministry of Forests, Lands and Natural Resource Operations' assessment approach for visual resources has been successfully used in numerous environmental assessments in B.C.
- There is uncertainty in the prediction of stakeholders' perceptions of effects on visual resources

A summary of residual effects is outlined in Table 27.10.

Table 27.10 Characterization of Residual Visual Resources Effects

Activity	Effect	Residual Environmental Effect								
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Probability	Level of Confidence
Construction	Changes to visual resources	Adverse	Moderate	Local	Medium Term	Continuous	Irreversible	Disturbed	High	Moderate
Operations	Changes to visual resources (shoreline erosion)	Adverse	Moderate	Local	Far future	Continuous	Irreversible	Disturbed	High	Moderate

27.7.2 Standards of Thresholds for Determining Significance

The general level of existing visible disturbances in the LAA and all of the residual effects criteria were taken into consideration in the determination of significance, as described above in Section 27.7.1. Particular consideration was given to magnitude, duration, and frequency as the relevant criteria for determining significance. These criteria primarily determine how area users would experience the Project. Since visual resources are considered in the context of human perception of aesthetics, the experience of the visual landscape by observers is a key element of the assessment. Together, magnitude, duration, and frequency measure how much the Project would change the visible landscape and whether it would be a permanent change.

Social context and the general level of existing disturbances were also considered, as they provide an understanding of the existing visual environment and of the ability of and readiness for people and communities to adapt to changes in the visual landscape.

Residual effects would be identified as significant if effects were rated as high magnitude, combined with long term in duration and continuous in frequency, and if the level of introduced visible disturbances would exceed the general level of existing visible disturbances in the LAA.

27.7.3 Determination of Significance of Residual Effects

While the effects of the Project are rated as long-term duration and high frequency, they are not rated a high magnitude, and are not predicted to exceed the general (historical) level of existing visible anthropogenic disturbances (including industrial developments) in the LAA. In addition, the social context illustrates an environment that has been previously disturbed by human development (as opposed to a pristine environment). Effects on visual resources are therefore not considered significant.

Table 27.11 summarizes the significance of residual effects.

Table 27.11 Summary of Assessment of Potential Significant Residual Adverse Effects

Project Phase	Potential Adverse Effect	Key Mitigation Measures	Significance Analysis of Residual Effects
Construction	Changes to visual resources	After disturbance activities cease, disturbed surfaces in construction areas will be restored and revegetated in accordance with the Project Soil Management, Site Restoration, and Revegetation Plan. The Shoreline Protection in Hudson's Hope will be naturally landscaped. Permanent Site C dam site buildings and other above-ground structures will be painted to blend in with the character of the surrounding environment where possible. Where feasible, previously disturbed areas, or areas generally hidden from view, will be selected for the potential off-site workforce accommodation camps.	Not significant
Operations and maintenance	Changes to visual resources (shoreline erosion)	N/A	Not significant

NOTE:

N/A = not applicable

27.8 Cumulative Effects Assessment

27.8.1 Screening of Cumulative Effects

A screening of the Project's potential contribution to the cumulative effects of past, current, and announced future Projects was done per the procedures described in Volume 2 Section 10 Effects Assessment Methodology.

The potential residual adverse effects of the Project on visual resources include increases in the amount of visible anthropogenic disturbances in relation to base conditions during the construction and operations phases.

Other projects that are expected to occur in the RAA during the potential construction and operations phases of the Project and interact with residual visual resource effects of the Project are listed in Table 27.12.

Table 27.12 Potential Cumulative Effects to Visual Resources

Site C Clean Energy Project Residual Effect	Other Project	Description of Project	Potential Overlap with Site C	Potential Cumulative Effect Interaction with Visual Resources
Increase in the amount of visible anthropogenic disturbances	Spectra Energy Transmission North 2012 expansion	Expansion facilities of the west coast pipeline system to provide incremental firm transmission service from receipt points along the Fort Nelson mainline to the NOVA Gas Transmission Groundbirch pipeline within the Montney formation, 6 km north of Dinosaur Lake	After construction is completed, minimal visible disturbances are expected	No
	Montney Gas Play	Shale rock deposit containing large quantities of natural gas; a high level of shale gas exploration and drilling activities are expected	Exploration and drilling activity will increase the amount of visible anthropogenic disturbances	Yes
	Land Tenure	Applications for oil, gas, water, range, and other land tenures Forest harvest plans	Land use activities will increase the amount of visible anthropogenic disturbances	Yes

The Montney Gas Play Project and land tenure applications are expected to affect visual resources in the RAA. Assessment of the cumulative effects of changes in visual resources is included in the sections below.

27.8.2 Description of Cumulative Effects

Increased exploration and drilling activity associated with the Montney Gas Play in the RAA would likely introduce additional visible anthropogenic disturbances in the landscape throughout the RAA. This would include short-term disturbances such as the placement of temporary drilling equipment (rigs) and long-term changes such as clearing of vegetation and the construction of well pads and access roads. Activities associated with the Montney Gas Play are expected to be present in the long term.

Applications for *Land Act* tenures, new oil and gas facilities and forestry harvest plans and tenures would partially overlap spatially with the RAA. These activities would represent a continuation and, potentially an expansion, of existing land use activities (oil and gas exploration, forestry, and grazing) and would likely introduce additional visible anthropogenic disturbances in the landscape. These activities are expected to be present in the long term.

27.8.3 Cumulative Effects Mitigation Measures

It is assumed that proponents of exploration and drilling activities will minimize visual disturbances by entering road use agreements with other operators in the area.

27.8.4 Residual Cumulative Effects

Residual cumulative effects would be expected. The Project, together with other projects expected to occur in the RAA (as listed in Table 27.12), is predicted to increase the amount of visible anthropogenic disturbances in relation to base conditions.

27.8.5 Characterization of Residual Cumulative Effects

For both construction and operations, the magnitude of effect is rated as moderate since the amount of introduced visible disturbance would not exceed the general level of visible disturbances in the RAA. Changes would be considered within historical norms based on the Peace River valley and the RAA having been exposed to a range of visible anthropogenic disturbances, including changes resulting from one other similar hydroelectric power plant and oil and gas development. The geographic extent of the effect is the RAA and therefore is considered local.

The duration of effect would be medium term during construction and long term during operations.

The capacity of the visual landscape to accept change (context) is rated as medium, since a considerable amount of visible anthropogenic disturbance already exists within other parts of the RAA (similar extent as LAA), including the Peace River valley. With this existing context, some additional disturbances could be accommodated without changing the overall character of the visual landscape.

The probability of the effect to occur is rated high. Due to the lack of data regarding footprints and layouts of the reasonably foreseeable projects, the level of confidence in estimating this cumulative effect is low.

Residual cumulative effects on visual resources are summarized in Table 27.13.

Table 27.13 Characterization of Residual Visual Cumulative Effects

Activity	Effect	Residual Cumulative Environmental Effect									
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Probability	Level of Confidence	Significance
Construction	Changes to visual resources	Adverse	Moderate	Local	Short Term	Continuous	Irreversible	Disturbed	High	Low	Not Significant
Operations	Changes to visual resources (shoreline erosion)	Adverse	Moderate	Local	Long Term	Continuous	Irreversible	Disturbed	High	Low	Not Significant

27.8.6 Determination of Significance of Residual Cumulative Effects

Cumulative residual effects within the LAA would be identified as significant, if effects were rated as high magnitude, combined with long term in duration and continuous in frequency (see Section 27.4).

Cumulative effects on visual resources are rated as not significant, as they do not meet this threshold.

27.9 Monitoring and Follow-Up

No monitoring or follow-up programs are proposed for visual resources.

References

Literature Cited

Berry, R. 2004. An Evaluation of GIS and Spatial Datasets for Visual Impact Analysis. Unpublished MSc dissertation at University of Glamorgan. Pontypridd, Wales, UK.

BC Hydro. 2012a. Site C Clean Energy Project, Project Activity Zone as of May 14, 2012. Unpublished database. Vancouver, B.C.

BC Hydro. 2012b. Site C Clean Energy Project, Project Activity Zone as of October 1, 2012. Unpublished database. Vancouver, B.C.

British Columbia (B.C.) Ministry of Forests, Lands and Natural Resource Operations. 1997. Visual Landscape Inventory: Procedures and Standards Manual. B.C. Forest Practices Branch. Victoria, B.C.

British Columbia (B.C.) Ministry of Forests, Lands and Natural Resource Operations. 2001. Visual Impact Assessment Guidebook. Second Edition. B.C. Forest Practices Branch. Victoria, B.C.

Dodd, H.M. 2001. The Validity of Using a Geographic Information System's Viewshed Function as a Predictor for the Reception of Line-of-sight Radio Waves. MA Thesis. Department of Geography, Virginia Polytechnic Institute and State University. Blacksburg, VA.

Edwin, Reid & Associates. 1979. Peace River Site C Hydro-Electric Development Recreation Impact Assessment. Prepared for BC Hydro & Power Authority. Vancouver, B.C.

Kedzior, A. 2007. 2.5D Modelling – Measuring Accuracy of Viewshed Analysis. MA Thesis. Department of Geographical Information Systems, Kingston University: London, England.

Minister of Environment of Canada and the Executive Director of the BCEAO. 2012. Site C Clean Energy Project Environmental Impact Statement Guidelines. September 5, 2012 Pursuant to the British Columbia *Environmental Assessment Act* and the *Canadian Environmental Assessment Act*. Victoria, B.C. and Ottawa, ON.

Riggs, P.D. and D.J. Dean. 2007. An Investigation into the Causes of Errors and Inconsistencies in Predicted Viewsheds. Transactions in GIS. 11(2):175–196.

Internet Sites

British Columbia (B.C.) Ministry of Forests, Lands and Natural Resource Operations. 2012a. Recreation Resources Inventory Online. Available at: https://webmaps.gov.bc.ca/imf5/imf.jsp?site=mofr_rec. Accessed: June 2012.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2012b. Vegetation Resources Inventory Online. Available at: http://www.for.gov.bc.ca/hts/vri/. Accessed: June 2012.

National Topographic Database (NTDB). 2012. Canadian Digital Elevation Data. Available at: http://geogratis.cgdi.gc.ca/geogratis/en/index.html. Accessed: June 2012.