

5.0 ENVIRONMENTAL IMPACT ASSESSMENT METHODS

The methods that are used to conduct the environmental impact assessment (EIA) of the Project are described in this section. The EIA uses a methodological framework developed by Stantec to meet the combined requirements of the *Canadian Environmental Assessment Act (CEAA)* and the New Brunswick *Environmental Impact Assessment Regulation* (the “EIA Regulation”). These EIA methods are based on a structured approach that, particularly:

- considers the mandatory and discretionary factors under Section 16 of *CEAA*;
- considers all federal and provincial regulatory requirements for the assessment of environmental effects as defined by *CEAA*, with specific consideration of the requirements of a) the Final Terms of Reference for an Environmental Impact Assessment approved by the Governments of New Brunswick and Canada in April 2012 (Stantec 2012a), and b) the Final Guidelines for an Environmental Impact Assessment (NBENV 2009) as issued by NBDELG;
- considers the issues raised by the public, Aboriginal persons, ENGOs, and other stakeholders during consultation and engagement activities conducted to date;
- focuses on issues of greatest concern that arise from the above considerations; and
- integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning and management process.

CEAA defines the term “environment” as:

“environment” means the components of the Earth, and includes

(a) land, water and air, including all layers of the atmosphere,

(b) all organic and inorganic matter and living organisms, and

(c) the interacting natural systems that include components referred to in paragraphs (a) and (b).

The New Brunswick *Clean Environment Act* defines “environment” as:

“environment” means the air, water and soil”.

For the purpose of this EIA Report, the definition of “environment” under *CEAA* shall be used, as it more broadly encompasses the combined biophysical and human environment in its definition.

The EIA will focus on specific environmental components (called valued environmental components or VECs) that are of particular value or interest to regulatory agencies, the public, other stakeholder groups, and First Nations. VECs are typically selected for assessment on the basis of: regulatory issues, guidelines, and requirements; consultation with regulatory agencies, the public, stakeholder groups, and First Nations; field reconnaissance; and the professional judgment of the Study Team.

For the purpose of this EIA Report, the term “environmental effect” is as defined in CEAA and broadly refers to a change in the environment in response to a Project activity. Specifically:

“environmental effect” means, in respect of a project,

- (a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the Species at Risk Act,*
- (b) any effect of any change referred to in paragraph (a) on
 - (i) health and socio-economic conditions,*
 - (ii) physical and cultural heritage,*
 - (iii) the current use of lands and resources for traditional purposes by aboriginal persons, or*
 - (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or**
- c) any change to the project that may be caused by the environment,*
whether any such change or effect occurs within or outside Canada.

For convenience, the term “environmental effect” as defined in CEAA will be taken to be synonymous to the term “impact” as referred to in the EIA Regulation. As such, the EIA Report will assess environmental effects and impacts as defined by the respective federal and provincial legislation.

Taken together, the definitions of “environment” and “environmental effect” in CEAA include the biophysical and human environments. As such, socioeconomic components that are part of the human environment are encompassed in the definition of “environmental effect” as defined in CEAA, insofar as they may be indirectly affected by changes in the biophysical environment. Thus, for the purpose of this EIA Report, the term “environment” includes the biophysical, human, and socioeconomic components as defined in CEAA, as they are required by both the federal and provincial governments.

5.1 OVERVIEW OF APPROACH

The environmental assessment methods address both Project-related and cumulative environmental effects. Project-related environmental effects are changes to the biophysical or human environment that will be caused by a project or activity arising solely as a result of the proposed principal works and activities, as defined by the scope of the Project and as described in the Project Description (Chapter 3). Cumulative environmental effects are changes to the biophysical or human environment that are caused by an action associated with the Project, in combination with other past, present or reasonably foreseeable future projects or activities that have been or will be carried out.

Project-related environmental effects and cumulative environmental effects are assessed using a standardized methodological framework for each VEC, with standard tables and matrices used to facilitate the evaluation. The residual Project-related environmental effects (*i.e.*, after mitigation has been applied) are characterized using specific criteria (*e.g.*, direction, magnitude, geographic extent, duration, frequency, reversibility, and ecological/socioeconomic context). These criteria are described in the guidance of the CEA Agency (FEARO 1994) and the Final EIA Guidelines (NBENV 2009) and Terms of Reference for the Project (Stantec 2012a), and they are specifically defined for each VEC. The significance of the Project-related environmental effects is then determined based on pre-defined criteria or thresholds (also called significance criteria) that reflect a variety of considerations based on these criteria and other relevant considerations.

If there is overlap between the environmental effects of the Project and those of other projects or activities that have been or will be carried out, cumulative environmental effects are assessed to determine whether they could be significant, and to consider the contribution of the Project to them.

The environmental effects assessment methodology used in this EIA is shown graphically in Figure 5.1.1. This methodology involves the following generalized steps.

- **Scope of Assessment** – Scoping of the assessment includes the selection of VEC (and, if required, key indicators for the VEC) and the rationale for its selection; influence of consultation and engagement on the scoping of the VEC; selection of the environmental effect(s); description of measurable parameters; description of temporal, spatial, administrative, and technical boundaries; and identification of thresholds that are used to determine the significance of environmental effects. This step relies upon the scoping undertaken by regulatory authorities; the requirements of the Final Guidelines and the Terms of Reference; consideration of the input of the public, stakeholders, and First Nations that influenced the scope of the assessment; and the professional judgment of the Study Team.
- **Existing Conditions** – Existing (baseline) environmental conditions are established for the VEC. In many cases, existing conditions implicitly include those environmental effects that may have been or may be caused by other past or present projects or activities that have been or are being carried out.
- **Assessment of Project-Related Environmental Effects** – Project-related environmental effects are assessed. The assessment includes descriptions of how an environmental effect will occur or how the Project will interact with the environment, the mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect, and the characterization of the residual environmental effects of the Project. The focus is on residual environmental effects, *i.e.*, the environmental effects that remain after planned mitigation has been applied. All mandatory factors under Section 16(1) and 16(2) of *CEAA* are assessed for all phases of the Project (*i.e.*, Construction, Operation, and Decommissioning, Reclamation and Closure), as well as for Accidents, Malfunctions and Unplanned Events. The evaluation also considers the effects of the environment on the Project.

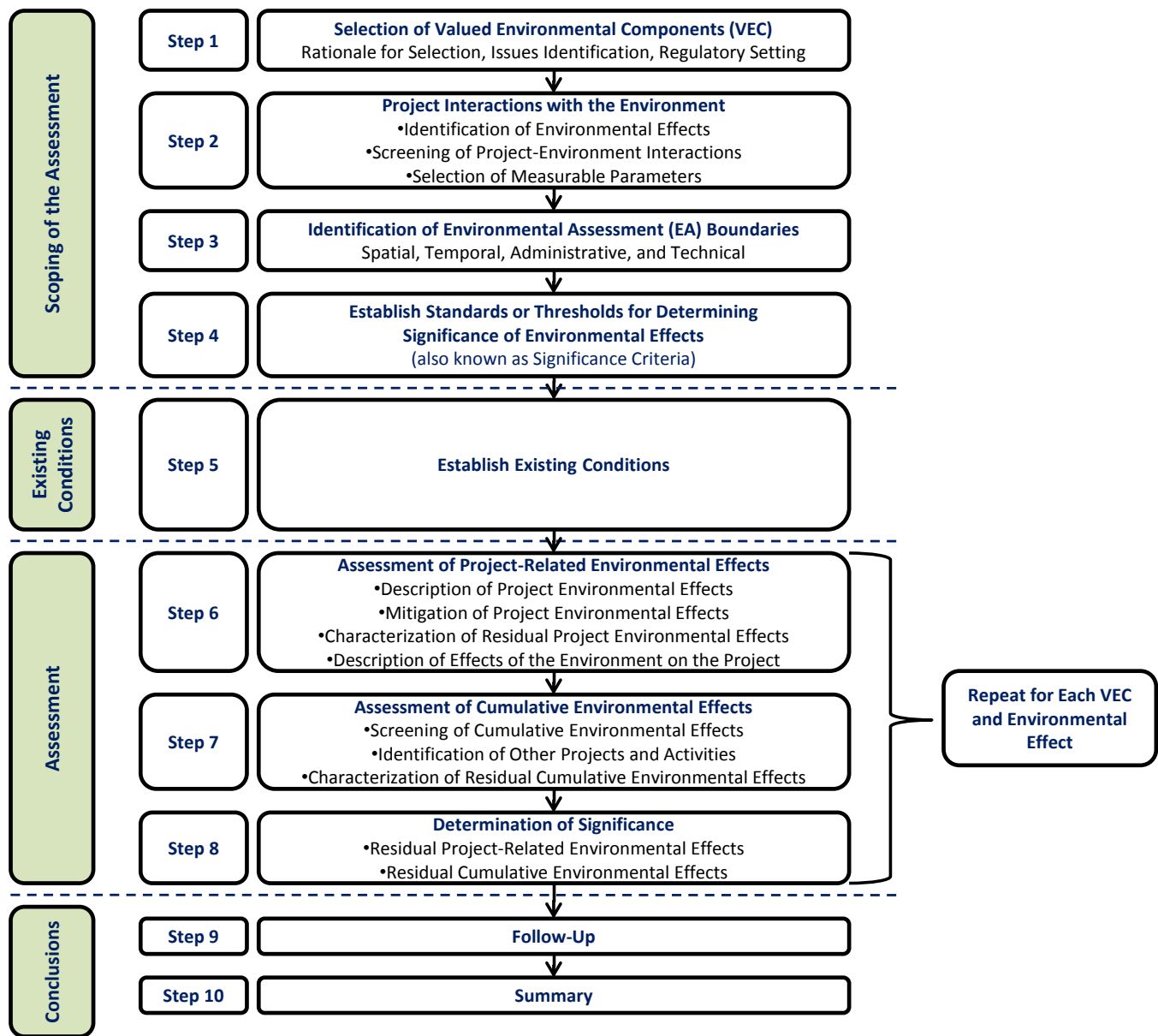


Figure 5.1.1 Summary of Stantec EIA Methodology

- Assessment of Cumulative Environmental Effects** – Cumulative environmental effects of the Project are identified in consideration of other past, present or reasonably foreseeable future projects or activities that have been or will be carried out, for all phases of the Project (*i.e.*, Construction, Operation, and Decommissioning, Reclamation and Closure). A screening of potential interactions is completed to determine if an assessment of cumulative environmental effects is required (*i.e.*, there is potential for substantive interaction) for that specific Project-related environmental effect that overlaps with those of other projects or activities that have been or will be carried out. The residual cumulative environmental effects of the Project in combination with other projects or activities that have been or will be carried out are then

evaluated, including the contribution of the Project to those cumulative environmental effects (as applicable).

- **Determination of Significance** – The significance of residual Project-related and residual cumulative environmental effects, including the contribution of the Project, is then determined, in consideration of the significance criteria.
- **Follow-up or Monitoring** – Follow-up measures that are required to verify the environmental effects predictions or to assess the effectiveness of the planned mitigation, as well as any required monitoring, are recommended, where appropriate and applicable.

Further details on the methodologies that will be used in this EIA are provided in the sub-sections that follow.

5.2 SCOPING OF THE ASSESSMENT

Issues identified through scoping (Chapter 4) are analyzed and grouped into categories to assist in the selection of VECs. VECs are defined as broad components of the biophysical and human environments that, if altered by the Project, would be of concern to regulatory agencies, Aboriginal persons, resource managers, scientists, stakeholders, and/or the general public. These issues, along with the requirements of the Final Guidelines (NBENV 2009) and Terms of Reference for the EIA (Stantec 2012a), form the scope of the environmental assessment (*i.e.*, scope of Project, factors to be considered, and scope of factors to be considered) for the Project.

As discussed in Chapter 4, confirming the recommendations of the Terms of Reference (Stantec 2012a), the following VECs have been selected for this EIA to focus the assessment of environmental effects:

- Atmospheric Environment;
- Acoustic Environment;
- Water Resources;
- Aquatic Environment;
- Terrestrial Environment;
- Vegetated Environment;
- Wetland Environment;
- Public Health and Safety;
- Labour and Economy;
- Community Services and Infrastructure;

- Land and Resource Use;
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons;
- Heritage Resources; and
- Transportation.

The environmental effects analysis for each VEC is conducted in its own dedicated subsection within Chapter 8 of the EIA Report. In addition, the effects of the environment on the Project are assessed. Credible Accidents, Malfunctions and Unplanned Events are also assessed for all VECs, on an event basis, in a dedicated section at the end of Chapter 8 of the EIA Report. That section includes the assessment of the consequent environmental effects arising from the effects of the environment on the Project. Such consequent environmental effects are considered accidents, malfunctions or unplanned events as Project design and mitigation is intended to ensure that such events are not likely to occur in a manner that is adverse for the Project. In the environmental effects assessment for accidents, malfunctions and unplanned events, the focus is more on the consequences than the causal mechanisms.

The scope of assessment with respect to each VEC is described in the following sub-sections.

5.2.1 Rationale for Selection of Valued Environmental Component, Regulatory Context, and Issues Raised During Engagement

The rationale for the selection of each VEC is first described. A brief summary of the regulatory setting, ecological, and socioeconomic context of each VEC, and the influence of consultation or engagement on the assessment (as applicable) is also described. The goal is to describe the issues and concerns that arose through legislation, regulatory decision-making, or consultation and engagement activities that influenced the scope of the environmental assessment described in the EIA Report and led to identification of the environmental effects that will be assessed therein.

5.2.2 Selection of Environmental Effects and Measurable Parameters

The environmental effects for each VEC (and if applicable, key indicators) are defined in consideration of the regulatory context for the VEC, issues identified through consultation or engagement, and existing conditions.

For each VEC, one or more measurable parameters are selected to facilitate the measurement of potential Project-related environmental effects and cumulative environmental effects, as shown in Table 5.2.1.

Table 5.2.1 Example: Measurable Parameters for (Name of VEC)

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in (environmental effect 1)	Measurable parameter 1 (units)	• (Describe rationale for selecting the measurable parameter and how it assists to quantify the environmental effect).
	Measurable parameter 2 (units)	• (Describe rationale for selecting the measurable parameter and how it assists to quantify the environmental effect).

Table 5.2.1 Example: Measurable Parameters for (Name of VEC)

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
<i>(add more rows as needed for each environmental effect)</i>	<i>Measurable parameter 3 (units)</i>	<ul style="list-style-type: none"> <i>(Describe rationale for selecting the measurable parameter and how it assists to quantify the environmental effect).</i>
	<i>Etc.</i>	<ul style="list-style-type: none"> <i>(Describe rationale for selecting the measurable parameter and how it assists to quantify the environmental effect).</i>

The degree of change in these measurable parameters is used to characterize Project-related and cumulative environmental effects, which when compared to the defined significance criteria (Section 5.2.6 below), will assist in evaluating the significance of the potential environmental effects.

5.2.3 Temporal Boundaries

The temporal boundaries for the assessment are defined based on the timing and duration of Project activities and the nature of the interactions with each VEC. The purpose of a temporal boundary is to identify when an environmental effect may occur in relation to specific Project phases and activities. Temporal boundaries for the Project generally include the various phases of a Project, which for the Sisson Project have been identified as:

- Construction;
- Operation; and
- Decommissioning, Reclamation and Closure.

In some cases, it is necessary to further refine the temporal boundaries beyond simply limiting them to a specific phase of the Project. This is carried out as necessary within each environmental effects analysis sub-section. Temporal boundaries for the assessment may reflect seasonal variations or life cycle requirements of biological VECs or forecasted trends for socioeconomic VECs.

5.2.4 Spatial Boundaries

Spatial boundaries are established for the assessment of potential Project-related environmental effects and cumulative environmental effects for each VEC. The primary consideration used in the establishment of the boundaries of these assessment areas is the probable geographical extent of the environmental effects (*i.e.*, the zone of influence) to the VEC.

Spatial boundaries represent the geographic extent of the VEC, as they pertain to potential Project-environment interactions. Spatial boundaries are selected to reflect the geographic extent over which Project activities will or are likely to occur, and as such, they may be different from one VEC to another depending on the characteristics of the VEC. Generally, the spatial boundaries are referred to as the Project Development Area (PDA), the Local Assessment Area (LAA), and the Regional Assessment Area (RAA), as required.

- The **Project Development Area (PDA)** is the most basic and immediate area of the Project. The PDA is limited to the anticipated area of physical disturbance associated with the Construction and Operation of the Project. For this Project, the PDA consists of an area of

approximately 1,253 hectares (ha) that includes the area of physical disturbance associated with the open pit, ore processing plant, storage areas, tailings storage facility (TSF), quarry, and related facilities. The PDA also includes a site access road linking the Project site to the existing network of forest roads, internal site roads connecting the various Project facilities, the relocation of the Fire Road and the existing 345 kV transmission line traversing the PDA, and a new 138 kV transmission line linking the Project site to existing electrical transmission infrastructure at Keswick, approximately 46 km to the southeast of the Project site.

- The **Local Assessment Area (LAA)** is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA is commonly referred to as the “zone of influence” of the Project, and may include areas that could experience Project environmental effects that arise beyond the area of physical disturbance by the Project. The LAA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur. The definition of the LAA varies from one VEC to another, depending on local conditions, species abundance, socioeconomic factors, cultural values, and other factors.
- The **Regional Assessment Area (RAA)** is the area within which the Project’s environmental effects may overlap or accumulate with the environmental effects of other projects or activities that have been or will be carried out such that cumulative environmental effects may potentially occur. The RAA will be defined for each VEC depending on physical and biological conditions and the type and location of other past, present, or reasonably foreseeable projects or activities that have been or will be carried out.

5.2.5 Administrative and Technical Boundaries

As appropriate, Administrative and Technical Boundaries are identified and justified for each VEC.

Administrative boundaries include specific aspects of provincial and federal legislative or regulatory requirements; standards, objectives, or guidelines, policy objectives; as well as regional planning initiatives that are relevant to the assessment of the Project’s environmental effects on the VEC. Common examples of administrative boundaries include ambient air quality objectives for the Atmospheric Environment VEC, zoning or basic planning statements for the Land and Resource Use VEC, the prohibition to affect migratory birds or their nests as part of the Terrestrial Environment VEC, and the like.

Technical boundaries are the technical limitations or considerations for the evaluation of potential environmental effects of the Project, and may include limitations in scientific and social information, data analyses, and data interpretation, or uncertainties in the assessment.

5.2.6 Thresholds for Determining the Significance of Residual Environmental Effects

Threshold criteria or standards for determining the significance of environmental effects are identified for each VEC, beyond which a residual environmental effect would be considered significant. These are generally selected in consideration of provincial and federal regulatory requirements, standards, objectives, guidelines that are applicable to the VEC, societal values, or other planning objectives as developed in the Administrative Boundaries section. They have been developed in consideration of guidance and past practice (*e.g.*, as described by Barnes *et al.* 2012), and adapted to the specific

conditions of the receiving environment of the Project and the nature of the potential environmental effects. These thresholds were also included in the government-approved Terms of Reference for the EIA, as required by the Final Guidelines.

In some cases, and particularly where standards, objectives, guidelines or regulatory requirements do not specifically exist, thresholds can be defined for measurable parameters to support measurement that informs the determination of significance.

5.3 EXISTING CONDITIONS

The existing conditions for each VEC are then described, including:

- the status and characteristics of the VEC within its defined spatial and temporal boundaries for the assessment;
- information from past research conducted in the region;
- traditional and ecological knowledge (if applicable or available); and
- knowledge gained from the collection of baseline data through literature review, qualitative and quantitative analyses, and field programs carried out as part of the EIA.

5.4 ENVIRONMENTAL EFFECTS ASSESSMENT

5.4.1 Potential Project-VEC Interactions

Interactions between all relevant Project activities and each environmental effect of the VEC are summarized in tabular format, as shown in Table 5.4.1.

Table 5.4.1 Example: Potential Project Environmental Effects to the (Name of VEC)

Project Activities and Physical Works	Potential Environmental Effects
	Change in (Environmental Effect 1)
Construction	
Activity 1	X
Activity 2	X
Activity 3 (add more rows as necessary)	X
Operation	
Activity 1	X
Activity 2	X
Activity 3 (add more rows as necessary)	X
Decommissioning, Reclamation and Closure	
Activity 1	X
Activity 2 (add more rows as necessary)	X
Project-Related Environmental Effects	
Notes:	
Project-Related Environmental Effects were ranked as follows:	
0	No substantive interaction. The environmental effects are rated not significant and are not considered further in this report.
1	Interaction will occur. However, based on past experience and professional judgment, the interaction would not result in a significant environmental effect, even without mitigation, or the interaction would clearly not be significant due to application of codified practices and/or permit conditions. The environmental effects are rated not significant and are not considered further in this report.
2	Interaction may, even with codified mitigation and/or permit conditions, result in a potentially significant environmental effect and/or is important to regulatory and/or public interest. Potential environmental effects are considered further and in more detail in the EIA.

Detailed information on the Project activities is provided in Chapter 3. Interactions are ranked according to the potential for an activity to interact with each VEC, according to the following.

- If there is no substantive interaction between a Project activity and the VEC, an assessment of environmental effects is not required. The level of interaction is ranked as 0 and the environmental effects are not considered further in the EIA. The environmental effects of these activities are thus, by definition, rated not significant, with a high level of confidence.
- If a potential interaction between a Project activity and the VEC is identified, but not likely to be substantive in light of planned mitigation, the level of interaction is ranked as 1. Such interactions are well understood and are subject to prescribed mitigation or codified practices. These interactions are subject to a less detailed environmental effects assessment and rated not significant; however, justification is provided for such categorizations and the proposed mitigation described. Such interactions can be mitigated with a high degree of certainty with proven technology and practices. Following this discussion and ranking, the environmental effects of this activity are not considered further in the EIA.
- If a potential interaction between a Project activity and the VEC is identified that may result in more substantive environmental effects despite the planned mitigation, or if there is less certainty regarding the effectiveness of mitigation, the level of interaction is ranked as 2. These potential interactions are subjected to further evaluation in the EIA and a more detailed environmental effects analysis and consideration in the EIA is carried out in order to predict, mitigate, and evaluate potential environmental effects (including cumulative environmental effects).

The use of the 0, 1, and 2 rankings above for Project-environment interactions facilitates the environmental assessment in a manner that focuses the assessment on the key issues of concern for each VEC. Justification for assigning these ranks for each environmental effect and VEC is then provided following the ranking. The Study Team takes a precautionary approach, whereby interactions with a meaningful degree of uncertainty are assigned a ranking of 2, ensuring that a more thorough evaluation is conducted.

5.4.2 Assessment of Project-Related Environmental Effects

Project-related environmental effects are assessed. The assessment is carried out in tabular form (Table 5.4.2) to facilitate the evaluation, followed by a detailed discussion of how the project may interact with the environment, mitigation measures, and the characterization of residual project environmental effects. Further details are as follows.

Table 5.4.2 Example: Summary of Residual Project-Related Environmental Effects on (Name of VEC)

Potential Residual Project-Related Environmental Effects	Project Phases, Activities, and Physical Works	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics						Significance	Prediction Confidence	Likelihood	Cumulative Environmental Effects?	Recommended Follow-up or Monitoring
			Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Ecological/Socioeconomic Context					
Change in (Environmental Effect 1)	Construction <ul style="list-style-type: none"> Activity 1 Activity 2 Activity 3 	<ul style="list-style-type: none"> Describe mitigation. Describe mitigation. Describe mitigation. 	X	X	X	X/X	X	X	X	X	X	X	<ul style="list-style-type: none"> Describe follow up or monitoring. Describe follow up or monitoring. Describe follow up or monitoring.
	Operation <ul style="list-style-type: none"> Activity 1 Activity 2 Activity 3 	<ul style="list-style-type: none"> Describe mitigation. Describe mitigation. Describe mitigation. 	X	X	X	X/X	X	X	X	X	X	X	<ul style="list-style-type: none"> Describe follow up or monitoring. Describe follow up or monitoring. Describe follow up or monitoring.
	Decommissioning, Reclamation and Closure <ul style="list-style-type: none"> Activity 1 Activity 2 Activity 3 	<ul style="list-style-type: none"> Describe mitigation. Describe mitigation. Describe mitigation. 	X	X	X	X/X	X	X	X	X	X	X	<ul style="list-style-type: none"> Describe follow up or monitoring. Describe follow up or monitoring. Describe follow up or monitoring.
	Residual Environmental Effects for all Phases								X	X	X	X	

Table 5.4.2 Example: Summary of Residual Project-Related Environmental Effects on (Name of VEC)

Potential Residual Project-Related Environmental Effects	Project Phases, Activities, and Physical Works	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics						Significance	Prediction Confidence	Likelihood	Cumulative Environmental Effects?	Recommended Follow-up or Monitoring
			Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Ecological/Socioeconomic Context					
<p>KEY</p> <p>Direction P Positive. A Adverse.</p> <p>Magnitude L Low: (define). M Medium: (define). H High: (define).</p> <p>Geographic Extent S Site-specific: (define). L Local: (define). R Regional: (define).</p>	<p>Duration ST Short-term: (define). MT Medium-term: (define). LT Long-term: (define). P Permanent: (define).</p> <p>Frequency O Occurs once. S Occurs sporadically at irregular intervals. R Occurs on a regular basis and at regular intervals. C Continuous.</p>	<p>Reversibility R Reversible. I Irreversible.</p> <p>Ecological/Socioeconomic Context U Undisturbed: Area relatively or not adversely affected by human activity. D Developed: Area has been substantially previously disturbed by human development or human development is still present. N/A Not Applicable.</p> <p>Significance S Significant. N Not Significant.</p>	<p>Prediction Confidence Confidence in the significance prediction, based on scientific information and statistical analysis, identified technical boundaries, professional judgment and known effectiveness of mitigation: L Low level of confidence. M Moderate level of confidence. H High level of confidence.</p> <p>Likelihood If a significant environmental effect is predicted, the likelihood of that significant environmental effect occurring is determined, based on professional judgment: L Low probability of occurrence. M Medium probability of occurrence. H High probability of occurrence.</p> <p>Cumulative Environmental Effects? Y Potential for environmental effect to interact with the environmental effects of other past, present or foreseeable future projects or activities in RAA. N Environmental effect will not or is not likely to interact with the environmental effects of other past, present or foreseeable future projects or activities in RAA.</p>										

5.4.2.1 Potential Project Environmental Effects Mechanisms

For each Project-related activity previously ranked as 2, as discussed above, the assessment of each Project-related environmental effect begins with a description of the mechanisms whereby specific Project activities and actions could result in the environmental effect. Where possible, the spatial and temporal extent of these changes (*i.e.*, where and when the environmental effect might occur) are also described.

It is important to note that the EIA focuses on residual environmental effects, *i.e.*, environmental effects after mitigation has been applied. Environmental effects before mitigation are not quantified or assessed, nor is the significance of the environmental effect before mitigation.

5.4.2.2 Mitigation of Project Environmental Effects

Mitigation measures that may help to reduce or eliminate an environmental effect are described, with an emphasis on how these measures help to reduce the environmental effect. Mitigation is defined as a change in the temporal or spatial aspects of the Project and/or the means in which the Project is constructed, operated, or decommissioned, over and above the Project design aspects described in Chapter 3. In addition, mitigation can include specialized measures such as habitat offsetting, replacement, or financial compensation, as well as planned environmental management and response measures (*e.g.*, environmental and social management system, component management plans).

5.4.2.3 Characterization of Residual Project Environmental Effects

Residual environmental effects (*i.e.*, the environmental effects that remain after mitigation has been applied) are described during each Project phase, taking into account how the proposed mitigation would alter or change the environmental effect. The analysis includes both direct and indirect interactions between the Project and the VEC. The analysis considers mitigation measures to reduce adverse environmental effects or to enhance positive environmental effects, as applicable and appropriate. Once mitigation measures are applied, any remaining environmental effect is residual. Only residual environmental effects are assessed for significance.

Environmental effects for each VEC are characterized for each applicable Project phase and activity, and presented in an environmental effects summary table (Table 5.4.2). The characteristics of residual environmental effects include:

- **Direction** – the ultimate long-term trend of the environmental effect (*i.e.*, positive or adverse);
- **Magnitude** – the amount of change in a measurable parameter or variable relative to existing (baseline) conditions, defined for each VEC as low, medium, high, or other qualifier as deemed appropriate;
- **Geographic Extent** – the area where an environmental effect of a defined magnitude occurs, defined for each VEC based on definitions of PDA, LAA, and RAA as appropriate;
- **Frequency** – the number of times during the Project or a specific Project phase or activity that an environmental effect might occur (*e.g.*, one time or multiple times) in a specified time period;

- **Duration** – the period of time required until the VEC returns to its baseline condition or the environmental effect can no longer be measured or otherwise perceived (e.g., short-term, mid-term, long-term, or in some cases permanent);
- **Reversibility** – the likelihood that a measurable parameter will recover from an environmental effect, including through active management techniques (e.g., habitat restoration); and
- **Ecological/Socioeconomic Context** – the general characteristics of the area in which the Project is located, as indicated by past and existing levels of human activity.

A key is provided at the bottom of each environmental effects summary table (Table 5.4.2) which defines these characteristics as necessary for each VEC based on the specific boundaries (*i.e.*, temporal, spatial, administrative, and technical) and significance criteria selected for each VEC. Where possible, these characteristics are described quantitatively for each residual environmental effect. Where these characteristics cannot be expressed quantitatively, they are described qualitatively specifically for the VEC or environmental effect.

Mitigation and recommended follow-up or monitoring measures are also described, as applicable.

Following the assignment of these characteristics, residual environmental effects are described and discussed for the VEC during each Project phase, taking into account how mitigation will alter or change the environmental effect.

5.4.3 Assessment of Cumulative Environmental Effects

The cumulative environmental effects of the Project in combination with other projects or activities that have been or will be carried out are assessed. The assessment is carried out in tabular form to facilitate the evaluation, followed by a detailed discussion of how the Project may overlap with other projects or activities that have been or will be carried out and interact with the environment, mitigation measures, and the characterization of residual cumulative environmental effects. Further details are as follows.

5.4.3.1 Identification of Other Projects or Activities

Other projects or activities that have been or will be carried out are identified for inclusion in the cumulative environmental effects assessment, based on their potential for residual environmental effects that could overlap spatially and temporally with the residual environmental effects of the Project. The environmental effects of other past and present projects or activities that have been carried out are generally reflected in the existing baseline environment, and are therefore more appropriately and logically considered in the Project-related environmental effects assessment for each VEC. The assessment and evaluation of the cumulative environmental effects of the Project in combination with other projects or activities that will be carried out considers the nature and degree of change from these baseline environmental conditions due to both the Project and the other projects or activities.

The screening of other projects or activities relevant to the cumulative environmental effects assessment is generally based on the criteria described in Table 5.4.3. The other projects or activities identified for consideration in the cumulative environmental effects assessment for this EIA were described in Section 4.5.

Table 5.4.3 Criteria for Identification of Other Projects or Activities That Have Been or Will Be Carried Out, for the Cumulative Environmental Effects Assessment

Criteria	Rationale and Application
<p>Status of other project or activity:</p> <ul style="list-style-type: none"> Past or present project, or a project or activity that is certain, planned, or reasonably foreseeable. 	<p>The environmental effects of past or present projects or activities that have been carried out are evaluated in the assessment of environmental effects of the Project. In some cases, the cumulative environmental effects assessment does not specifically consider past or present projects or activities because the environmental effects resulting from past or present projects or activities are captured in the description of baseline conditions or encompassed in those existing environmental conditions. The exceptions are recently initiated projects or activities where the environmental effects are recent and may not be fully reflected in the baseline conditions, or projects or activities that will probably change in scope in the foreseeable future.</p> <p>Certain, planned, or reasonably foreseeable future projects or activities that will be carried out are those that have a high probability of being implemented, and include the following projects proximal to the Project:</p> <ul style="list-style-type: none"> Those undertakings that are currently registered under the New Brunswick <i>Environmental Impact Assessment Regulation</i> (under review), and are listed on the NBDELG website (NBDELG 2012a; available at http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/Registrations-Engegistremets/EIA.pdf) for the purposes of this EIA, the NBDELG listing as of March 29, 2013 has been used as the basis for the identification of those future projects or activities; Those currently undergoing an EA under CEAA, and are listed on the Canadian Environmental Assessment Registry website (CEA Agency 2012a; available at http://ceaa-acee.gc.ca/050/index-eng.cfm); and Those that have been publicly announced as being under serious consideration by proponents but have not yet been formally registered, or that will be registered in the near future. <p>Reasonably foreseeable projects or activities are highly likely to be implemented and include those identified in approved development plans or those that are in advanced stages of planning. Hypothetical and speculative projects or activities are not considered as part of the cumulative environmental effects assessment.</p>
<p>Potential for overlap related to timing of the project and/or activity:</p> <ul style="list-style-type: none"> Other project or activity must be carried out or implemented during the time frame that is relevant to the Project. 	<p>The Project involves the following phases and associated timeframes.</p> <ul style="list-style-type: none"> Construction: Construction spanning a period of up to 24 months, expected to begin in late 2015. Operation: Starting with commissioning immediately following Construction, and continuing for approximately 27 years or until the mineral resource is depleted. Decommissioning, Reclamation and Closure: Decommissioning of Project facilities and Reclamation and Closure of the Project site will occur following the completion of Operation. <p>The timeframe for other projects or activities relevant to the cumulative environmental effects assessment must overlap with these periods for the Project, in that they will extend through Construction, Operation, and/or Decommissioning, Reclamation and Closure.</p>
<p>Potential for a spatial overlap of environmental effect:</p> <ul style="list-style-type: none"> Other project or activity must be located within the RAA as defined in the environmental effects analysis for each VEC. 	<p>Projects with an identified or expected zone of influence that may overlap with the geographic area likely to be affected by the Project (including VEC spatial boundaries) are of interest.</p>

Where a cumulative environmental effects assessment is completed for a VEC, only those projects or activities that could result in an overlapping environmental effect are included in the cumulative environmental effects assessment. The specific projects or activities and actions considered for each environmental effect are outlined in the assessment for the VEC.

5.4.3.2 Screening for Cumulative Environmental Effects

After completing the assessment of potential Project-related environmental effects on the VEC, where residual environmental effects are identified, a cumulative environmental effects assessment is conducted for those Project-related environmental effects that may overlap with the environmental effects of other projects or activities that have been or will be carried out.

The screening for cumulative environmental effects is conducted to determine if there is potential for a cumulative environmental effect. A series of three questions is used to screen cumulative environmental effects:

- Is there a Project-related environmental effect?
- Does the Project-related environmental effect overlap with those of other past, present or future projects or activities that have been or will be carried out?
- Is the Project contribution to cumulative environmental effects substantive and measurable or discernible such that there is some potential for substantive cumulative environmental effects that are attributable to the Project?

If, based on these three questions, there is potential for cumulative environmental effects, it is assessed to determine if it has the potential to shift a component of the natural or human environment to an unacceptable state.

Residual Project-related environmental effects for each VEC are reviewed for potential spatial and temporal overlap with similar environmental effects of other projects or activities. As shown in Table 5.4.4, overlapping projects or activities with the environmental effects of the Project are ranked as 0, 1, or 2 in a manner similar to that described for Project-VEC interactions in Section 5.4.1 (Table 5.4.1) to quantify the level of interaction or overlap between the environmental effects of the Project and those of other projects or activities that have been or will be carried out.

Table 5.4.4 Example: Potential Cumulative Environmental Effects to the (Name of VEC)

Other Projects or Activities With Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Change in (Environmental Effect 1)
Past or Present Projects or Activities That Have Been Carried Out	
<i>Other Project/Activity 1</i>	X
<i>Other Project/Activity 2</i>	X
<i>Other Project/Activity 3 (add more lines as needed)</i>	X
Potential Future Projects or Activities That Will Be Carried Out	
<i>Other Project/Activity 1</i>	X
<i>Other Project/Activity 2</i>	X
<i>Other Project/Activity 3 (add more lines as needed)</i>	X

Table 5.4.4 Example: Potential Cumulative Environmental Effects to the (Name of VEC)

Other Projects or Activities With Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects Change in (<i>Environmental Effect 1</i>)
<p>Cumulative Environmental Effects Notes: Cumulative environmental effects were ranked as follows: 0 Project environmental effects do not act cumulatively with those of other projects or activities that have been or will be carried out. 1 Project environmental effects act cumulatively with those of other projects or activities that have been or will be carried out, but are unlikely to result in significant cumulative environmental effects; or Project environmental effects act cumulatively with existing significant levels of cumulative environmental effects but the Project will not measurably contribute to these cumulative environmental effects on the VEC. 2 Project environmental effects act cumulatively with those of other projects or activities that have been or will be carried out, and may result in significant cumulative environmental effects; or Project environmental effects act cumulatively with existing significant levels of cumulative environmental effects and the Project may measurably contribute to adverse changes in the state of the VEC.</p>	

The use of the 0, 1, and 2 rankings above for identifying overlapping cumulative environmental effects facilitates the environmental assessment in a manner that focuses the assessment on the key issues of concern for each VEC, where the environmental effects of the Project overlap those of other projects or activities. Only projects or activities that are ranked as 2 in Table 5.4.4 are included in the assessment of potential cumulative environmental effects. Interactions ranked as 0 or 1 are discussed and justified, and by definition the resulting residual cumulative environmental effects are rated not significant, with a high level of confidence.

5.4.3.3 Cumulative Environmental Effects Mechanisms

For those cumulative environmental effects ranked as 2, the assessment of each cumulative environmental effect begins with a description of the environmental effect and the mechanisms whereby the Project environmental effects may interact with other projects or activities in the RAA as defined for a particular VEC. Where possible, the cumulative environmental effect is quantified in terms of the degree of change in the appropriate measurable parameter(s) and the spatial and temporal extent of these changes (*i.e.*, where and when the interactions between the Project’s residual environmental effects and the residual environmental effects of other projects or activities might occur). The assessment is carried out in tabular form (Table 5.4.5), supported by sufficient justification in the subsequent text.

As the assessment focuses on residual environmental effects, cumulative environmental effects before mitigation are not characterized. The significance of the cumulative environmental effect before the application of mitigation is not described or assessed.

Table 5.4.5 Example: Summary of Residual Cumulative Environmental Effects on the (Name of VEC)

Cumulative Environmental Effects	Case	Other Projects, Activities and Actions	Mitigation / Compensation Measures	Residual Cumulative Environmental Effects Characteristics						Significance	Prediction Confidence	Likelihood	Recommended Follow-up or Monitoring
				Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Ecological/Socioeconomic Context				
Change in (Environmental Effect 1) • describe; • describe; • describe.	Cumulative Environmental Effects with Project	• List other projects, activities or actions that have environmental effects overlapping with those of the Project.	• List proposed mitigation measures.	X	X	X	X/ X	X	X	X	X	X	• List follow up or monitoring programs.
	Project Contribution to Cumulative Environmental Effects			X	X	X	X/ X	X	X	X	X	X	
KEY Direction P Positive. A Adverse. Magnitude L Low: (define). M Moderate: (define). H High: (define). Geographic Extent S Site-specific: (define). L Local: (define). R Regional: (define).		Duration ST Short-term: (define). MT Medium-term: (define). LT Long-term: (define). P Permanent: (define). Frequency O Occurs once. S Occurs sporadically at irregular intervals. R Occurs on a regular basis and at regular intervals. C Continuous.	Reversibility R Reversible. I Irreversible. Ecological/Socioeconomic Context U Undisturbed: Area relatively or not adversely affected by human activity. D Developed: Area has been substantially previously disturbed by human development or human development is still present. N/A Not Applicable. Significance S Significant. N Not Significant.	Prediction Confidence Confidence in the significance prediction, based on scientific information and statistical analysis, identified technical boundaries, professional judgment and known effectiveness of mitigation: L Low level of confidence. M Moderate level of confidence. H High level of confidence. Likelihood If a significant environmental effect is predicted, the likelihood of that significant environmental effect occurring is determined, based on professional judgment: L Low probability of occurrence. M Medium probability of occurrence. H High probability of occurrence. Other Projects, Activities, or Actions List of specific projects or activities that would contribute to the cumulative environmental effects.									

5.4.3.3.1 Use of Temporal Cases

Where several environmental effects are evaluated in a particular VEC, or where the screening of cumulative environmental effects identifies that a detailed evaluation of these cumulative environmental effects is required, temporal cases are defined where appropriate and helpful to assist in the assessment of cumulative environmental effects. Where this occurs, cumulative environmental effects are generally described for three cases, as follows.

- **Base Case** – describes the current status of the measurable parameter(s) for the environmental effect prior to the start of the Project, including all appropriate past and present projects or activities. The Base Case will normally be presented in the existing conditions of the VEC, with explicit reference to the fact that the Base Case reflects the contributions of past and present projects or activities.
- **Project Case** – describes the status of the measurable parameter(s) for the environmental effect with the Project in place, over and above the Base Case. This is usually assessed using the peak environmental effect of the Project or the maximum active footprint for the Project.
- **Future Case** – describes the status of the measurable parameter(s) for the environmental effect as a result of the Project Case in combination with all reasonably foreseeable future projects or activities that will be carried out. Reasonably foreseeable future projects are defined as future projects or activities that will occur with some certainty, including projects that are in some form of regulatory approval process or where a public announcement to seek regulatory approval has been made (*i.e.*, they are likely to occur).

The comparison of the Project Case with the Future Case allows the Project contribution to cumulative environmental effects of all past, present, and reasonably foreseeable projects or activities that have been or will be carried out (*i.e.*, Future Case) to be determined.

5.4.3.4 Mitigation of Cumulative Environmental Effects

As with Project environmental effects, mitigation measures that would reduce the cumulative environmental effects are described, with an emphasis on those measures that would help to minimize the interaction of the Project-related environmental effect with similar environmental effects from other projects, activities, and actions. Three types of mitigation measures are generally considered, as applicable:

- measures that can be implemented solely by the Proponent;
- measures that can be implemented by the Proponent in cooperation with other project proponents, government, Aboriginal organizations, the public, and/or other stakeholders; and
- measures that can be implemented independently by other project proponents, government, Aboriginal organizations, the public, and/or other stakeholders.

5.4.3.5 Characterization of Residual Cumulative Environmental Effects

Residual cumulative environmental effects are described and assessed, taking into account how the proposed mitigation will alter or change the cumulative environmental effect. As described for Project-related environmental effects (Section 5.4.2), cumulative environmental effects are characterized where applicable and appropriate in terms of the direction, magnitude, geographic extent, frequency, duration, reversibility, and ecological or socioeconomic context (Table 5.4.5). The contribution of the Project to cumulative environmental effects is assessed where there is a potential for substantive overlapping environmental effects to occur.

5.5 DETERMINATION OF SIGNIFICANCE

5.5.1 Determination of Significance of Residual Project Environmental Effects

A determination of the significance of Project environmental effects is made using thresholds of significance defined for the VEC and/or the measurable parameters (Section 5.2), beyond which a residual environmental effect would be considered significant. The determination of significance may be made along with the assessment of Project-related environmental effects, or in a separate Determination of Significance section.

The significance determination for Project-related environmental effects is based on significance criteria that reflect a variety of considerations based on criteria defined in guidance (*i.e.*, direction, magnitude, geographic extent, duration, frequency, reversibility, and ecological/socioeconomic context) and other relevant considerations. Other considerations can include other measurable parameters that may better characterize significance, including legislation, and other regulatory standards or other thresholds of acceptability, as described by Barnes *et al.* (2012). These determinations of significance inform decision-making under both the federal and provincial decision-making processes. The level of confidence of the significance determination is identified, in consideration of factors such as the certainty of the scientific information and statistical analysis, identified technical boundaries, professional judgment, and known effectiveness of proposed mitigation.

Where the environmental effects are determined to be significant, there is further consideration of the likelihood of occurrence of that significant environmental effect, based on past experience and the professional judgment of the Study Team. Additionally, since the federal EIA of the Project is a comprehensive study under *CEAA*, if a significant residual environmental effect is likely to occur, the assessment must include consideration of the capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of present and those of the future.

5.5.2 Determination of Significance of Residual Cumulative Environmental Effects

A determination of the significance of residual cumulative environmental effects is then made using the same standards or thresholds for significance developed for the VEC and/or the measurable parameters. As with residual Project environmental effects, the determination of residual cumulative environmental effects includes a discussion of the level of confidence in the prediction (Section 5.5.1). The determination of significance may be made along with the assessment of cumulative environmental effects, or separately in the Determination of Significance section.

5.6 FOLLOW-UP OR MONITORING

A follow-up program is used, where applicable, to verify environmental effects predictions or to verify the effectiveness of mitigation measures. A monitoring program includes compliance measures used to verify that mitigation was applied or to demonstrate compliance with the requirements of environmental laws or regulations, or the conditions of permits, approvals or authorizations issued under such laws or regulations.

Appropriate follow-up measures are proposed for consideration by regulatory authorities where the scientific uncertainty of the environmental effects predictions or the effectiveness of mitigation warrants the need for such programs. Environmental monitoring measures to demonstrate compliance with legislation or to monitor environmental quality for other purposes are also described as appropriate for consideration by regulatory authorities.

5.7 POTENTIAL ACCIDENTS, MALFUNCTIONS AND UNPLANNED EVENTS

Accidents, malfunctions and unplanned events are assessed for the Project. Potential accidents, malfunctions and unplanned events are identified based on the Project Description using historical performance data for other similar projects at a regional, provincial, national or international scale, as appropriate. Where applicable, for each accident, malfunction, or unplanned event, one or more scenarios relating to how the accident, malfunction, or unplanned event might occur during the life of the Project are developed. The focus of the evaluation is on credible accidents, malfunctions and unplanned events that have a reasonable likelihood of occurring during the lifetime of the Project based on the nature of the Project and the environmental effects that may occur, or for those that could result in significant environmental effects even if their likelihood of occurrence is low. Details on the types of accidents, malfunctions and unplanned events considered in this EIA are provided in Section 8.17.

For each event and/or scenario, a preliminary screening is conducted to determine if the event and/or scenario is likely to affect each identified VEC (Table 5.7.1). Potential interactions are ranked using the same criteria as for Project-VEC interactions (Section 5.4).

Table 5.7.1 Example: Potential Interactions between VECs and (Accident / Malfunction / Unplanned Event 1)

Valued Environmental Component (VEC)	Accident/Malfunction / Unplanned Event 1	
	Scenario A	Scenario B
VEC 1	X	X
VEC 2	X	X
VEC 3	X	X
VEC 4	X	X
VEC 5	X	X
<p>Notes: Interactions between Accidents/Scenarios and the respective VECs were ranked as follows: 0 No interaction, or no substantive interaction contemplated. 1 Interaction may occur. However, based on past experience and professional judgment, the interaction would not result in a significant environmental effect, even without mitigation, or the interaction would clearly not be significant due to application of codified practices. 2 Interaction may, even with codified mitigation, result in a potentially significant environmental effect and/or is important to regulatory and/or public interest. Potential environmental effects are considered further and in more detail in the EIA.</p>		

For interactions that are ranked as 2, potential environmental effects of the event and/or scenario on the VEC are assessed. Environmental effects are characterized using the same terms as routine Project-related environmental effects (Section 5.4).

Cumulative environmental effects of accidents, malfunctions, or unplanned events, however, are not assessed as it is not reasonably foreseeable to have overlapping Project-related accidents with those from other projects or activities that will be carried out.

The significance of the Project-related environmental effects for each accident, malfunction, or unplanned event and its likelihood of occurrence is then determined using the same thresholds as determined for the Project-related environmental effects on each applicable VEC.