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5 – ASSESSMENT METHODS AND FRAMEWORKS

5.1 INTRODUCTION

The assessment methods and framework for the Casino Project Proposal have been developed in accordance with the Proponent's Guide for Information Requirements for Executive Committee Project Proposal Submissions (YESAB 2005a). The purpose of the assessment is to provide information requirements necessary for review by the Executive Committee under YESAA.

Five key steps are involved in the effects assessment of the Project:

1. Characterize environmental values and socio-economic values to identify Valued Components (VCs) relevant to the Project and the assessment. The VCs are identified through consultation with First Nations, governmental organizations, regulatory authorities, the public, as well as the professional knowledge of CMC and the assessment team. VCs are selected based on environmental, scientific, social, aesthetic, or cultural reasons. The purposes of identifying VCs are to improve the effectiveness and efficiency of the assessment, facilitate the selection of appropriate study methods and focus the analysis on potential key project-environment interactions; components not identified as VCs may be assessed as intermediate components in the effect pathways for VCs.
2. Set spatial and temporal assessment boundaries. Spatial boundaries are delineated to encompass the physical and socio-economic environment that could reasonably be expected to be directly or indirectly affected by the Project. Temporal boundaries are set to define the time frame over which the assessment will occur.
3. Characterize effects. The effects are characterized by determining the current conditions in which the VC exists; identifying how, when, and where the Project is anticipated to interact with the VC; and identifying how the interactions could affect the VC. Effects are characterized against baseline (or pre-Project) conditions.
4. Identify mitigation measures for the elimination, reduction, or control of adverse environmental or socio-economic effects on the VC. Mitigation measures as outlined by YESAB include restitution, restoration, replacement, compensation, or other appropriate means. For beneficial environmental or socio-economic effects of the Project, where possible, opportunities to enhance the beneficial effects are identified as enhancement measures (Canadian Environmental Assessment Agency 2010).
5. Determine significance of residual effects, those that remain after the implementation of mitigation measures, and provide a discussion of the level of confidence in the prediction.

Residual effects of the Project that remain after the implementation of mitigation measures are carried forward into the Cumulative Effects Assessment (CEA). Cumulative effects are defined by YESAB as incremental changes to VCs as a result of the combined influences of the proposed project in conjunction with other projects or activities. The CEA follows similar steps as the effects assessment of the Project (YESAB 2005a):

1. Identification of VCs chosen for the CEA. For the Project, the VCs chosen for the CEA are the same as those used in the effects assessment of the Project.
2. Setting spatial and temporal assessment boundaries. For the CEA, the spatial scope will consider regional pressures on the VC and encompass known or likely effects originating from other projects and activities on the VC with the RSA. The temporal boundary includes other projects and activities occurring in the past or present, and those with a reasonable likelihood to occur in the future that will potentially

overlap temporally with the life of the Casino Project. A master list of projects and activities that could have an interaction with the residual effects of the Project is provided in Appendix 5B of this Proposal.

3. Characterization of other assumed residual effects and identification of the other assumed residual effects that have the potential to spatially and temporally overlap with the residual effects of the Project. Identification and characterization of the potential cumulative effects that may occur.
4. Identification of additional mitigation measures that CMC or other parties can implement to address cumulative effects and discussion of the anticipated effectiveness of additional mitigation measures and the potential for residual cumulative effects.
5. Determine the significance of residual cumulative effects, those that remain after the implementation of mitigation measures, and provide a discussion of the level of confidence in the prediction.

5.2 SCOPE OF THE ASSESSMENT

5.2.1 Valued Components Selection and Rationale

For this Proposal, VCs are defined as environmental and socio-economic components of the environment that are considered by CMC, public, First Nations, technical specialists, YESAB or other government agencies involved in the assessment process to have scientific, ecological, economic, social, cultural, archaeological, historical, or other importance.

The selection of VCs for the Project was informed by professional judgement and the experience of CMC and its consultants and through discussions with YESAB, First Nations, and local community representatives. All VCs selected for the Proposal shared common attributes:

- The VC was considered to have importance;
- The VC is relevant to YESAA requirements;
- A potential Project-VC interaction exists because the VC is potentially affected by Project components and/or activities and is the receptor component; and
- Assessing the Project-VC interaction is feasible because the resulting effect pathways can be clearly understood.

Components that were not selected as VCs were:

- Intermediate components along an effect pathway between the Project and the receptor VC;
- Not responsive to the Project components or activities;
- Management plans and actions, such as Cyanide Management or Emergency Response;
- Better represented by another VC to avoid redundant analysis; and
- Legally binding government requirements exist to protect the component which is intended to avoid potential adverse effects and additional detailed analysis within the context of the Proposal is not needed.

The Proposal is structured and driven by the selected VCs and components not identified as a VC are not explicitly assessed as its own section; these components may be assessed as intermediate components in the effect pathways for VCs or considered in the context of other requirements of the Proposal. The VCs selected for the Proposal are intended to be comprehensive, so that when they are collectively considered, they enable full understanding of the important environmental and socio-economic potential effects of the Project.

The environmental and socio-economic VCs selected and the rationale for their inclusion are presented in Table 5.2-1 along with a sample of components that were not selected as VCs and the rationale for their exclusion. Selected VCs are assessed in detail in Sections 6 through 19 of this Proposal.

Table 5.2-1 Selection of Environmental and Socio-economic Valued Components

Valued Component	Definition	Rationale
Selected Valued Components		
Terrain Features	The geological surface features, topography, and layers of mineral and organic materials covering the underlying bedrock geology.	Terrain features were selected as VCs because of their importance to regional and localized ecological processes. Potential effects of the Project include loss of Beringian features that could be unique to this landscape; fugitive dust deposition or spills as a result of operational incidents affecting soil quality. The quality of soils affects vegetation health and growth, potentially changing vegetation communities. Erosion can affect the health of vegetation and aquatic ecosystems. Increased sedimentation in watercourses as a result of erosion can have detrimental impacts to fish, fish habitat and aquatic resources.
Water Quality	Water quality refers to key parameters such as total suspended solids, acidity, alkalinity, metals, sulphate, cyanide and nutrients.	Water quality was selected as a VC as it forms one of the vital links between the abiotic and biotic aquatic systems and is the foundation to supporting and maintaining healthy ecological processes fish, wildlife, and humans.
Air Quality	Air quality is the composition of outdoor air. Major air pollutants that will be assessed are sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter, as well as Greenhouse Gases (GHG).	Air quality was selected as a VC because mining activities such as fuel consumption, vehicle movement, and material transfer generate air emissions that could cause deterioration of ambient air quality. Clean air in the Yukon is valued unto itself, but additionally fugitive dust and particulate matter may affect receptors such as rare vegetation, wildlife, surface water quality, and soil.
Noise	Noise is commonly defined as a disagreeable sound; sound is the result of pressure vibrations.	Use of heavy equipment and machinery and increased human presence in the area will increase existing sound levels. In the Yukon, the tranquility of the landscape and lack of intrusion from anthropogenic sources holds an intrinsic value; increased noise levels could affect humans and wildlife.
Fish and Aquatic Resources	Fish and aquatic resources include habitat quality, habitat connectivity, water temperature, benthic invertebrate and periphyton population parameters, fish relative abundance, fish condition factor, fish tissue metal concentrations, and sedimentation in spawning areas.	The Proposal will assess the potential effects of the proposed Project on aquatic habitat loss and alteration, and lethal and sub-lethal effects on fish and other aquatic organisms. Primary and secondary producers such as periphyton and benthic invertebrates provide food sources for higher trophic levels (e.g., fish and birds), and are useful as indicators of overall aquatic health due to their relatively long-lived and sedentary life histories. Fish have ecological, cultural, recreational and commercial value as they support various fisheries, and constitute a fundamental role in aquatic ecosystem functioning.

Valued Component	Definition	Rationale
Rare Plants and Vegetation Health	Rare plants are defined as plant species identified as rare, and on the Yukon's Conservation Data Centre's watch or track list. Vegetation includes vascular plants and lichens. Part of the Project area falls within beringia, an area that may have some unique plants and plant ecosystem associations.	Rare Plants and Vegetation Health were selected as VCs due to the potential change in plant abundance because of direct loss of individual plants within the Project footprint, and the effect on plant health from fugitive dust Sensitive ecosystems such as wetlands and lichen-producing habitats are considered an indicator of Project effects on vegetation health.
Wildlife	Wildlife is defined within this assessment as terrestrial mammals, songbirds, raptors and waterfowl.	Wildlife was selected a VC because the Project will interact with wildlife through potential effects to individuals and populations, and their habitats. Wildlife are important because of their value to local people who rely on wildlife as a subsistence and economic resource, and for their intrinsic value as a symbol wilderness and a healthy ecosystem. Potential effects of the proposed Project on wildlife are primarily loss of available habitat due to the Project footprint; sensory disturbance from mine related activities; and mortality due to increased hunter access, collisions with vehicles, and destroying animals as a result of human-wildlife conflict. The assessment of the proposed Project's potential effect is focussed on a number of Key Indicators (KI). Particular species or species groups are selected as KIs to represent potential Project effects on wildlife. KI's for this project include the Klaza caribou herd, moose, grizzly bear, collared pika, cliff-nesting raptors, bird species at risk, and waterfowl.
Community Vitality	Demographic conditions and well-being of individuals, families, and communities.	Community Vitality was selected as a VC since the potential change in community demographics, and new project-related income and work schedules could affect social and behavioural and therefore affect the well-being of individuals, families, and communities. The key indicators selected to assess community vitality are Population and Demographics and Community Well-being.
Community Infrastructure and Services	Community Infrastructure and Services will be defined by Municipal infrastructure (water supply, water/sewage treatment, landfills, power supply, and recreational facilities); Housing; Transportation; Educational services; Health and Social Services; and Protective Services.	Community Infrastructure and Services were selected as VCs to capture concerns expressed by First Nations and communities in the study area. The potential effects of the proposed project on community's infrastructure and services in the study region will ultimately depend on the extent to which proposed Project activities and Project-related population growth will result in increased demands on regional infrastructure and services, and the ability of the local infrastructure to cope with increasing demands. This VC also evaluates the potential for some regional infrastructure development as a result of the proposed Project.

Valued Component	Definition	Rationale
Employability	Ability of local and regional residents to gain from Project-related employment opportunities.	Employability was selected as a VC to assess the qualifications and experience of local and regional residents. The Employability VC discusses the potential effects of the Project on educational level and experience of study area residents, and discusses training opportunities that maybe driven by the proposed Project.
Employment and Income	Labour availability and their ability to meet potential labour demands during the lifetime of the proposed Project.	Construction and operations of the proposed Project will create employment and income opportunities for residents. Employment and Income were selected as VCs to examine labour availability in the study communities, as well as direct, indirect and induced local employment and employment income derived from the proposed Project.
Economic Development and Business Sector	Economic Growth; Government Revenues; and Business Opportunities in the broader territorial economy.	Construction, operations, and decommissioning, and closure of the proposed Project would generate employment, income and business opportunities throughout Yukon. Economic Development and the Business Sector were chosen as VCs, since Project development would result in increased activity within the territorial economy.
Cultural Continuity	Defined by Traditional Language; Places of Historical and Archaeological Value; Traditional Knowledge; Social, Community and Cultural Activities; and Subsistence and Recreational Harvesting	Cultural continuity was selected as a VC to address the potential of the proposed Project to affect traditional activities and culture and existing heritage resources.
Land Use and Tenure	Land use refers to the human use of the land; land tenure refers to the legal regime governing land ownership.	Land Use and Tenure was selected as a VC due to the potential interactions of the Project with other land users in the area. The various land uses include: Parks and Protected Areas, Trapping and Guide Outfitting, Hunting and Fishing, Recreation and Tourism, Permits and Licenses, Mining and Mineral Claims, Forest Uses (firewood collection and gathering), Transportation and Access, Energy and Utilities, and Traditional Land Use.
Components Not Selected as Valued Components		
Hydrology	Surface water quantity (annual streamflow including peak and low flows)	Hydrology was not selected as a VC but is assessed as an intermediate component in the effect pathways for the Water Quality VC and Fish and Aquatic Resources VC. The baseline hydrology report and hydrology assessment are included as appendices of this Proposal.

Valued Component	Definition	Rationale
Hydrogeology	Groundwater flow rate and gradient.	Hydrogeology was not selected as a VC but is assessed as an intermediate component in the effect pathway for the Water Quality VC. A technical report is appended to the Proposal that provides detailed information on boundary conditions and aquifer properties; a conceptual model provides a generalized view of boundaries and hydrostratigraphic units potentially affected by the Project components and activities. Hydrogeological conditions such as hydraulic conductivity, porosity, average gradient, velocity, and travel time are described in the technical report.
Climate	Prevailing weather conditions in an area over a long period.	Climate was not selected as a VC but measured climate parameters (temperature, precipitation, wind direction, etc.) is integrated into the assessment of VCs such as Air Quality and Noise and are relevant to the calculation of hydrologic data.
Climate Change	A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties that persists for an extended period, typically decades or longer	Climate change was not selected as a VC because quantitative methods are not available to assess the Project's actual contribution or effects on climate change. The Proposal includes an assessment of the potential effects of Climate Change on the Project and predictions of the Project's contribution to greenhouse gases.
Health and Safety	Worker and public health and safety	Worker and public health and safety was not selected as a VC but is assessed as part of the assessment of other VCs, additional information requirements of YESAB (i.e. accidents and malfunctions) and through mandatory compliance with regulations. Worker Health and Safety: CMC will comply with the *Worker's Compensation Act and Regulations*, the *Occupational Health and Safety Act*, and the *Public Health and Safety Act*. Mine operations will be conducted in a manner to minimize risk through training, awareness, and continuous improvement. Worker health and safety will form a component of the detailed Occupational Health and Safety Plan developed as part of the Quartz Mining License application after the YESAB review. Human Health and Safety: Human health and safety is addressed as part of the water quality VC, air quality VC, noise VC, community vitality VC, community infrastructure and services VC, accidents and malfunctions and conceptual environmental management plans.

5.2.2 Assessment Boundaries

Assessment boundaries delineate the spatial and temporal scope of the Project assessment; the spatial boundary is known as the "study area", (YESAB 2006b). The temporal boundary is the time frame, or the period over which the effects are assessed (YESAB 2006b).

Spatial Bounding

Spatial boundaries are the geographical limits to which potential effects to a VC are expected to extend and beyond which effects are expected to become insignificant (YESAB 2006b). Spatial boundaries for each VC encompass areas that can be reasonably expected to be affected by the Project and beyond which potential effects are expected to be non-detectable. Study areas take into account the spatial range of the VC and any relevant ecological, technical, and social or political considerations (YESAB 2005a). Spatial boundaries for the effects assessment are determined on a VC-specific basis and are described in the relevant sections of the Proposal, as well as illustrated on maps of appropriate scale. Two spatial boundaries are delineated: the Local Study Area (LSA) and the Regional Study Area (RSA), which are defined as follows:

- LSA is the spatial area within close proximity to the project under review where direct effects are anticipated. The LSA is generally the Project footprint.
- RSA is the spatial area within which cumulative effects are assessed; it extends a distance from the project footprint in which both direct and indirect effects are expected to occur (Hegmann et. al. 1999). The RSA encompasses an area large enough to consider most regional pressures (YESAB 2006a).

Project effects on socio-economic VCs inherently assess cumulative effects issues because of the use of VCs or indicators that are representative of regional conditions (YESAB 2006b). Therefore, for socio-economic VCs such as Economic Development only one study area may be defined. Alternatively, study areas may be defined in relation to direct and indirect effects or induced effects (YESAB 2006b).

Temporal Bounding

Temporal boundaries are the periods of time examined in the effects assessment and account for the different phases of the Project (YESAB 2006b). A life of project schedule for the phases that make up the Casino Project is presented in Table 5.2-2. Some Project components and activities will span more than one Project phase.

Table 5.2-2 Casino Project Phases

Project Phase	Period
Construction (C)	4 years
Operation (O)	22 years
Closure and Decommissioning (CD)	3 years
Post-Closure (PC)	5 years

Life history characteristics for environmental VCs (e.g., winter or summer habitat use, migration periods) or in reference to any cyclical or seasonal aspects of socio-economic VCs (e.g., hunting seasons) are assessed in relation to the Project phases and discussed in detail in Sections 6 to 19 of this Proposal.

5.2.3 Traditional Knowledge Integration

CMC considers traditional knowledge and community knowledge integral to the assessment and has endeavoured to develop a sound understanding of First Nations and community issues and expectations for

incorporation into the assessment. Traditional Knowledge includes traditional ecological knowledge (knowledge about the environment) as well as "knowledge about cultural, economic, political and spiritual interrelationships" (CEA Agency 2013). First Nations and community knowledge elicited through consultation activities is incorporated where available into the baseline information for each VC and is given equal weight as all scientific information and other information, as required under YESAA.

5.2.4 Baseline Information

Baseline (pre-Project) information is presented for each VC. Baseline information includes information on the setting and condition in which the VC is found. Baseline information presented for each VC includes:

- Relative qualitative or quantitative data for regional and local study areas; and
- Relevant standards and guidelines followed in collecting and analysing data.

All sources of baseline information used to characterize the VC condition and setting will be presented, including any available traditional knowledge. Limitations or uncertainties associated with baseline information and analysis, including assumptions, and the reliability, variability, and confidence in the results are discussed for each VC in each section. An overview of the information and data are provided in the body of the Proposal; detailed data are provided in technical reports in the Appendices.

5.3 ANALYSIS OF PROJECT-SPECIFIC EFFECTS

5.3.1 Project Interactions and Potential Effects

The next step in the effects assessment is to identify all potential interactions between Project components and activities (for all Project phases) and the identified VC. The Project Components and Activities List used in the effects assessment is included in Appendix 5A. For VCs where there is predicted to be an intangible or value-based rather than physical interaction (e.g., Economic Development), or where an interaction is best understood by considering the Project as a whole, "Mine Development/Presence" is used as the Project component. Table 5.3-1 is a representative table summarizing the potential interactions between the Project components and activities and VCs. For each VC the cause-effect pathway, or mechanism of interaction, indicating how the Project component interacts with the VC is identified. Where the Project and VC is not anticipated to have an interaction, a rationale is provided. Potential mechanism(s) of interaction between the Project components and activities and the valued component are carried forward into the assessment by characterizing the potential effect(s).

Table 5.3-1 Potential Interactions between the Project and Valued Component

Project Components and Activities	**Project Phase**[1] (C, O, DC, PC)	**Potential Interaction** (Yes/No)	**Mechanism of Interaction/ Rationale for No Interaction**

Note:

1. C (Construction), O (Operation), DC (Decommissioning and Closure) and PC (Post-Closure) represent the Project phases when the potential interaction between the Project and valued component is anticipated to occur.
2. Potential mechanism(s) of interaction between the Project components and activities and the valued component are carried forward into the assessment by characterizing the potential effect(s).

Where an interaction is anticipated to occur between the Project and VC, the potential effect of the Project on the VC is described and characterized. This step includes identification of key indicators, also known as measureable

parameters or attributes, and an assessment of the direction of the potential effect (either adverse or beneficial). Potential effects of the Project are described and measured in terms of changes to VCs from baseline conditions, or existing guidelines or standards. Potential effects are summarized in tables as shown in Table 5.3-2. A detailed explanation as to how potential effects were predicted, such as predictive modelling and professional judgement, is provided in the text. Any underlying assumptions, data, or calculations leading to the results shown in the table will be discussed.

Table 5.3-2 Potential Effects of the Project

Mechanism of Interaction	Key Indicator(s)[1]	Project Phase[2] (C, O, DC, PC)	Potential Effect	Direction (Adverse/Beneficial)

Note:

1. Key indicators are defined as measurable parameters or attributes to qualitatively or quantitatively evaluate the potential effect.
2. C (Construction), O (Operation), DC (Decommissioning and Closure) and PC (Post-Closure) represent the Project phases when the potential interaction between the Project and valued component is anticipated to occur.

Based on the VC, the discussion of potential adverse and beneficial effects of the Project may include:

- Consideration of spatial boundaries of the potential effect associated with the VC;
- The temporal phases and specific Project components and activities associated with the potential effect;
- Measurable parameters to quantitatively or qualitatively evaluate the potential effect;
- Traditional and community knowledge;
- Land use planning information; and
- Socio-economic data and trends.

All potential effects of the Project on VCs are carried forward into the effects assessment. For adverse potential effects, mitigation measures will be proposed by CMC to eliminate, reduce or control the adverse environmental or socio-economic effects on VCs. For beneficial potential effects, where possible, CMC will consider opportunities to enhance the beneficial effects.

5.3.2 Identification of Mitigation Measures and Residual Effects

Where an adverse environmental or socio-economic effect on a VC is anticipated, mitigation measures are proposed to eliminate, reduce, or control the potential effect and include restitution measures such as replacement, restoration, compensation or other means (YESAB 2005a). Where a beneficial environmental and socio-economic effect on a VC is anticipated, where possible, opportunities to enhance the beneficial effect will be considered and are identified as enhancement measures. All mitigation and enhancement measures that are recommended for implementation will be technically, environmentally, and economically feasible. Mitigation and enhancement measures can include the following types:

- Project design and considerations;
- Revised Project design or alternate approaches;
- Management practices, worker training, pollution prevention technologies;

- Compensation or restoration activities; and
- Monitoring and management plans.

For each potential environmental and socio-economic effect, proposed mitigation and enhancement measures are identified in a table of the format shown in Table 5.3-3. A description of the proposed mitigation or enhancement measures, including implementation methodologies, proposed schedules and monitoring or management plans during the life of the Project will be provided in text.

Table 5.3-3 Proposed Mitigation Measures and Residual Effects

Potential Effect	**Project Phase**[1] (C, O, CD, PC)	**Direction** (Adverse/Beneficial)	**Proposed Mitigation Measure**[2] (or Enhancement Measure)	**Predicted Effectiveness** (Low, Moderate, High, Unknown)	**Residual Effect** (Yes/No)

Notes

1. C (Construction), O (Operation), DC (Decommissioning and Closure) and PC (Post-Closure) represent the Project phases when the potential interaction between the Project and valued component is anticipated to occur.
2. For beneficial potential effects, opportunities, where possible, to enhance potential environmental and socio-economic benefits are included as proposed enhancement measures.

For adverse potential effects, Table 5.3-3 will include a description (e.g., Low, Moderate, High, or Unknown) of the predicted effectiveness of the proposed mitigation measure to manage adverse environmental or socio-economic effects based on the criteria proposed in Table 5.3-4. The predicted effectiveness of the mitigation measures is a combination of the implementation experience of the proposed measure and the predicted response of the key indicator, measureable parameter or attribute after implementation. Where mitigation measures are proposed to be implemented for which there is little experience or for which there is some question as to their effectiveness, the potential risks and effects will be described. For beneficial potential effects, mitigation measures are not required because the beneficial effect is desirable and enhancement measures are proposed, if possible.

Table 5.3-4 Level of Predicted Effectiveness of Mitigation Measures

Predicted Effectiveness	Implementation Experience	Response of the Key Indicator, Measurable Parameter or Attribute
Low	The proposed mitigation measure has been implemented in a different circumstance (e.g., different industry with dissimilar settings) and there is low level of experience with implementation.	After implementation, there is still a major measurable change in the key indicator, measurable parameter or attribute from the baseline and a permanent effect.
Moderate	The proposed measure has been implemented in similar circumstances (e.g., different industry with similar settings) and there is moderate level of experience with implementation.	After implementation, there is still a measurable change in the key indicator, measurable parameter, or attribute from the baseline but the effect is not permanent.
High	The proposed measure has been implemented in the same circumstances (e.g., same industry with similar settings) and there is a high level of experience with implementation.	After implementation, there is no measurable change in the key indicator, measurable parameter or attribute from the baseline (e.g., there is no effect, or the effect returns to its baseline condition) or an enhancement is evident.
Unknown	The mitigation measure has not been tried elsewhere and there is an unknown level of experience with implementation.	After implementation, the response of the key indicator, measurable parameter or attribute compared to the baseline is unknown.

Effects of the Project (adverse and beneficial) that remain after the implementation of mitigation measures are referred to as residual effects and are identified in Table 5.3-3. In some cases, residual effects may be completely eliminated through mitigation measures such as compensation, particularly when compensation comprises of on-site or proximal habitat compensation. Only residual effects are carried forward into the next step of the effects assessment where the significance of each residual effect is characterized.

5.3.3 Significance of Residual Effects

The YESAA requires that both adverse and beneficial residual environmental and socio-economic effects be assessed for significance (YESAB 2006b). Residual effects are characterized against eight criteria and associated ratings, outlined in Table 5.3-5 with general definitions, and defined specifically for each VC in Sections 6 to 19 of this Proposal. These eight criteria describe both the characteristics of the residual effect (e.g., direction, magnitude) and the characteristics of the VC being considered (e.g., context) (Lawrence 2007).

Table 5.3-5 Criteria for Characterizing Residual Effects

Criteria	Rating	General Definition
Direction	Adverse	Long term trend of the residual effect.
	Beneficial	
Magnitude	Low	The amount or intensity of change of the residual effect.
	Medium	
	High	
Geographic Extent	Localized	The spatial extent over which the residual effect occurs.
	Widespread	
Duration	Short Term	The period of time over which the residual effect is measurable.
	Long Term	
	Permanent	
Frequency	Infrequent	The number of times the residual effect may occur.
	Frequent	
Reversibility	Reversible	Whether baseline conditions will return following cessation of an interaction.
	Irreversible	
Context	Low resilience	The ability of the VC to accommodate change.
	High resilience	
Probability of Occurrence	Low	The likelihood that the residual effect will occur.
	High	

Where legislation, thresholds, standards, or objectives exist to define criteria rating and are relevant to the assessment they will be used rather than comparative or relative criteria (Lawrence 2007). Similarly, quantitative values, if available, are used preferentially (when available) over qualitative criteria. The relative importance of each criterion in determining the overall significance of the residual effect will vary by VC and professional judgement will be used in determining if a criterion is given more or less weight in determining significance. In addition, the significance of the residual effect on a VC can be determined with consideration of one or more of the following factors (Canter 1999):

- Guidelines or standards outlined in laws, regulations, policies, etc.;
- Pre-defined thresholds;
- Setting (e.g., is the Project in a protected habitat or sensitive zone, or land-use zone);
- The intensity of the residual effect (e.g. anticipated percentage change and whether the change is within normal variability); and
- Public concerns.

All residual environmental and socio-economic effects (adverse and beneficial) and the significance determinations are summarized as shown in Table 5.3-6.

Table 5.3-6 Significance of Residual Effects

Residual Effect	Predicted Degree of Effect After Mitigation Measures								Significance of Residual Effect (Significant/Not Significant)
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Probability of Occurrence	
Residual Effect #1									
Residual Effect #2									

5.3.4 Discussion of Significance of Residual Effect

A concluding discussion is provided for each VC summarizing the residual effects. Additionally, a confidence rating is applied to the overall significance determination for residual effects as shown in Table 5.3-7. Confidence measures how well residual effects are understood including the consideration of the acceptability of the data and analysis methods used to predict and assess potential environmental and socio-economic effects. The confidence rating considers the accuracy and application of analytical tools, an understanding of the effectiveness of mitigation measures, and an understanding of known responses of the measurable parameters to potential effects. The confidence ratings are:

- Low (<50% confidence)-not confident in prediction and the prediction could vary considerably. The mechanism of interaction between the Casino Project and the VC is poorly understood and/or data or analyses are incomplete, leading to a high degree of uncertainty in the prediction.
- Moderate (50% to 80% confidence)-confident in prediction, and the prediction has moderate variability. The mechanism of interaction between the Casino Project and the VC is not fully understood, and/or data or analyses are incomplete, leading to a moderate degree of uncertainty in the prediction.
- High (>80% confidence) - confident in prediction and the prediction could have low variability. The mechanism of interaction between the Casino Project and the VC is well understood, and/or data for the analyses are complete, leading to a low degree of uncertainty in the prediction.

Table 5.3-7 Summary of Residual Effects

Residual Effect	Direction (Adverse/Beneficial)	Significance (Significant/Not Significant)	Level of Confidence (Low, Moderate, High)

5.4 CUMULATIVE EFFECTS ASSESSMENT

5.4.1 Introduction

Cumulative effects can be described as "The combined impacts that accumulate from a series of similar or related individual actions, contaminants, or projects" (YESAB 2005b). The residual effects of the Casino Project on VCs will be assessed in relation to the residual effects of other past, present or likely future projects and activities. In accordance with the YESAA, consideration must be given to (YESAB 2006a):

> "The significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of:
>
> (i) other projects for which proposals have been submitted under subsection 50(1), or
>
> (ii) other existing or proposed activities in or outside Yukon that are known to the designated office, executive committee or panel of the Board from information provided to it or obtained by it under this Act."

The magnitude of the combined effect can be additive (equal to the sum of individual effects from each project or activity) or synergistic (equal to an effect different than the sum) (YESAB 2006a).

5.4.2 Identification of other Projects and Activities that could lead to a Cumulative Effect

The Proposal includes a master list of all potential past, present and likely future projects and activities that could reasonably be expected to have a spatial or temporal interaction with the residual effects of the Casino Project (Appendix 5-B). These past, present and likely future projects and activities, at first glance, have the potential to lead to a cumulative effect with the residual effects of the Casino Project.

- Past projects and activities are defined as past projects and land use activities which are no longer active and have been closed.
- Present projects and activities are defined as existing and active projects and land use activities.
- Likely Future projects and activities are defined as reasonably foreseeable projects or landuse activities for which proposals have been submitted under subsection 50(1) of YESAA, or have entered into a formal project approval or permitting process.

The following information sources were reviewed or consulted to collate a preliminary list of projects or activities:

- Yukon Government department websites:
  - Yukon Environmental and Socio-economic Assessment Board Registry;
  - Yukon Land Use Planning Council;
  - Geomatics Yukon;
  - Environment Yukon; and
  - Energy, Mines and Resources.
- Mining Yukon;
- Yukon Outfitters Association website;
- First Nations websites; and
- Discussion with regulators, First Nations, and/or stakeholders.

The projects and activities identified in Appendix 5B include quartz mines, mineral and placer claims, heritage sites, and registered outfitting and trapline concessions. Appendix 5B will be used as master list for each VC to

identify other projects and activities that may spatially and temporally overlap with the residual effects of the Casino Project.

5.4.3 Residual Effects of Other Projects and Activities and Potential Cumulative Effects

Three conditions of the residual effects of past, present and likely future projects and activities must be met to warrant further assessment of cumulative effects with the Casino Project, including:

1. Adequate qualitative and/or quantitative information which is publicly available to allow for spatial and temporal characterization, and
2. Spatial overlap with the residual effects of the Casino Project, and
3. Temporal overlap with the residual effects of the Casino Project.

The assessment of potential cumulative effects is carried forward only when all three of the conditions are met.

The projects and activities identified in Appendix 5B will be reviewed for each VC to determine if there is adequate qualitative and/or quantitative information available to allow for spatial and temporal characterization of the assumed residual effect. Projects and activities that meet this condition will be summarized in a table of the format shown in Table 5.4-1. Projects and activities, identified in Appendix 5B, that don't meet this condition will not be carried forward in the CEA. Where numerous projects or activities in the same category (e.g., placer claims, quartz claims) are assumed to cause similar types of residual effects, these will be assessed collectively.

Table 5.4-1 Residual Effect Information for Other Projects or Activities

Projects or Activities	Status[1]	Assumed Residual Effect[2]	Spatial Extent of Assumed Residual Effect	Temporal Extent of Assumed Residual Effect
Activity A (e.g. Forestry)				
Project B (e.g. Placer Mining)				
Project C (e.g. Quartz Claim)				

Note

1. Status refers to Past, Present or Likely Future project or activity.
2. Assumed residual effects of other projects or activities are derived from professional judgement and focus on the key issues of concern for the VC, thereby ensuring that the CEA remains focussed and the analysis remains manageable and practical.

A CEA interaction matrix is used to indicate if there is a temporal and spatial overlap between the residual effects of the Casino Project and the assumed residual effects of other projects and activities, an example is shown in Table 5.4-2. If there is a potential for an interaction spatially and temporally, the cell is marked YES, and the interaction is analyzed. A cell marked YES does not presume there to be cumulative effect; rather, it is an indication that there is a potential for a cumulative effect. A detailed explanation will be provided in the text as to how the interactions were derived, by discussing any baseline information, the source of the information, and any underlying assumptions. If the cell is marked as NO, a rationale describing why there is no predicted interaction is provided in the text, and those residual effects are no longer carried forward in the assessment.

Table 5.4-2 Cumulative Effects Assessment Interaction Matrix

Casino Project Residual Effect	Potential Spatial and Temporal Overlap		
	Activity A (e.g. Forestry)	**Project B** (e.g. Placer Mining)	**Project C** (e.g. Quartz Claim)
	Assumed Residual Effect #1	Assumed Residual Effect #2	Assumed Residual Effect #3
Casino Project Residual Effect #1	YES	YES	NO
Casino Project Residual Effect #2	NO	NO	YES
Casino Project Residual Effect #3	NO	NO	NO

Note

1 YES is used to indicate where a residual effect of the Casino Project has the potential to overlap spatially and temporal with an assumed residual effects of other projects and activities.

Only assumed residual effects of other projects and activities that meet all three conditions are carried forward into the CEA as potential cumulative effects and summarized in a table as shown in Table 5.4-3.

Table 5.4-3 Potential Cumulative Effects

Casino Project Residual Effect	Project or Activity	Potential Cumulative Effect
Casino Project Residual Effect #1	Activity A (e.g. Forestry) Project B (e.g. Placer Mining)	Cumulative Effect #1
Casino Project Residual Effect #2	Project C (e.g. Quartz Claim)	Cumulative Effect #2

5.4.4 Proposed Mitigation Measures and Residual Cumulative Effects

Mitigating a local effect (i.e., a Project-specific effect) as much as possible is the best way to reduce potential cumulative effects (Hegmann et al. 1999, YESAB 2006a). The possibility of implementing additional mitigation measures by CMC or other parties responsible for the residual effects will be considered in the CEA. All potential cumulative effects on a VC are summarized in tabular format as shown in Table 5.4-4.

Mitigation measures applied or recommended for potential cumulative effects may be considerably different than those applied to Project-specific effects; often these additional mitigation measures will require regional stakeholder involvement, since recommendations for regional initiatives may be the only method to address complex regional cumulative effects (Hegmann et al. 1999). Additional Project-specific mitigation could include: recommending more effective primary control measures that are technically and economically feasible; compensation; or contribution of Project data and input for any regional planning initiatives (Hegmann et al. 1999). For socio-economic residual cumulative effects YESAB (2006a) recommends mitigation measures in the form of reparation such as the establishment of additional social infrastructure.

Table 5.4-4 Additional Mitigation Measures and Residual Cumulative Effects

Potential Cumulative Effect	Mitigation Measures for Project-Specific Effects[1]	Additional Mitigation[2] (if possible)	Effectiveness of Additional Mitigation Measure (Low, Moderate, High, Unknown)	Residual Cumulative Effect (Yes/No)
Potential Cumulative Effect #1				
Potential Cumulative Effect #2				

Note

1. Mitigation measures for Project-specific effects include mitigation measures that have been proposed by CMC to eliminate, reduce or control similar adverse environmental or socio-economic effects.
2. Additional mitigations measures may be either Project-specific mitigation for which CMC can implement or recommended mitigation measures for which other parties could implement.

5.4.5 Significance of Residual Cumulative Effect

The significance of cumulative effects is assessed following the same methodology and criteria used for determining the significance of residual Project-specific effects, as outlined in Section 5.3.3.

Table 5.4-5 Significance of Residual Cumulative Effects

Residual Cumulative Effect	Predicted Degree of Effect After Additional Mitigation Measures								Significance of Residual Cumulative Effect (Significant/Not Significant)
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Context	Probability of Occurrence	
Residual Cumulative Effect #1									
Residual Cumulative Effect #2									

5.4.6 Discussion of Significance of Residual Cumulative Effect

A concluding discussion is provided for each VC summarizing the residual cumulative effects. Additionally, a confidence rating is applied to the overall significance determination for residual cumulative effects as shown in Table 5.4-6 using the same criteria applied to determining the confidence ratings for Project-specific residual effects outlined in Section 5.3.4.

Table 5.4-6 Summary of Residual Cumulative Effects

Residual Cumulative Effect	**Direction** (Adverse/Beneficial)	**Significance** (Significant/Not Significant)	**Level of Confidence** (Low, Moderate, High)
Residual Cumulative Effect #1			
Residual Cumulative Effect #2			

5.5 SUMMARY AND CONCLUSIONS

A concluding discussion and summary is provided for the VC summarizing the residual effects and cumulative residual effects.