Comité consultatif pour l’environnement de la Baie James
James Bay Advisory Committee on the Environment
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A review of the application of cumulative effects assessment in the context of project environmental assessments: the James Bay Territory

Aura Environmental Research and Consulting Ltd.

May 2016

A review of the application of cumulative effects assessment in the context of Section 22 project environmental assessments conducted in the James Bay Territory

Prepared for the James Bay Advisory Committee on the Environment

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EXECUTIVE SUMMARY

Cumulative effects result from changes to the environment caused by an action in combination with other past, present and future actions. The tradition of cumulative effects assessment in Quebec, and across Canada, has been to focus on the individual, and incremental, impacts of project developments in combination with those of other actions in the project's local to regional environment. The practice of cumulative effects assessment, however, has been described as doing more harm than good: evaluating project impacts independently of other activities and concluding that projects are unlikely to cause cumulative effects; trading off the magnitude of a project's incremental impacts against the total effects of all other disturbances in the project's regional environment; or providing only a superficial analysis of cumulative effects and failing to follow-up to determine actual outcomes. Developers, or project proponents, are not fully to blame – they need only do what is set out in legislation or regulations, or required of them through project-specific terms of reference or directives.

This study examines the application of cumulative effects assessment under the James Bay and Northern Quebec Agreement (JBNQA). The study was commissioned by the James Bay Advisory Committee on the Environment in December 2015, due to concerns about the cumulative effects of multiple development projects that have, are, and may occur throughout the Territory. The study is part of an ongoing effort of the James Bay Advisory Committee on the Environment to be better prepared to provide advice to the signatory parties regarding cumulative effects assessments conducted during project-level environmental assessments under the James Bay and Northern Quebec Agreement.

This study reports in an analysis of seven environmental assessments, initiated and completed between 2002 and 2015, namely: Eastmain 1-A Powerhouse and Rupert Diversion, Eleonore Gold Mine, Bachelor Lake Gold Mine, Matoush Uranium Exploration, Renard Diamond Mine, Extension of Route 167 N to the Otish Mountains, and the Whabouchi Spodumene Mine. The focus of analysis is on the nature and quality of the instructions and guidance provided to proponents for the development of their cumulative effects assessments; how cumulative effects were addressed by the proponent; and whether and how cumulative effects requirements or issues identified in the project directives and impact statements were reflected in the decisions and project conditions.

Results of the study suggest that the quality of cumulative effects assessments in the James Bay Territory reflect the standards and practices set out in the project directives or terms of reference; however, the instructions and guidance provided to project proponents are often insufficient to facilitate good-practice cumulative effects assessment and to support the understanding and longer-term management of cumulative effects. Second, there is considerable variability in how cumulative effects are addressed in project impact statements, but overall cumulative effects receive insufficient attention, appear to be subjected to limited analysis, and the assessments often lack evidence to support the conclusions made about cumulative effects. Third, although the consideration of cumulative effects is a standard requirement in the directives issued to project proponents, there are typically few conditions placed on the project's approval that relate to managing or monitoring the project's cumulative effects - notwithstanding concerns about the state of practice identified in review committee or panel reports.

Results presented in this report may not be representative of *all* EA practices in the James Bay

Territory, but they do suggest considerable room for improvement in the current state of CEA.

LIST OF ACRONYMS

CE	Cumulative Effects
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Act
COMEV	Evaluating Committee
COMEX	Provincial Review Committee
COFEX-South	Federal Review Panel (South)
EA	Environmental Assessment
EIS	Environmental Impact Study
JBACE	James Bay Advisory Committee on the Environment
JBNQA	James Bay and Northern Québec Agreement
OPS	Operational Policy Statement
VC	Valued Component

1. INTRODUCTION

In December 2015, the James Bay Advisory Committee on the Environment (JBACE) approached Aura about the design and implementation of a study to examine the application of Cumulative Effects Assessment (CEA) in the context of Section 22 project Environmental Assessments (EAs) conducted in the James Bay Territory. The JBACE is interested in conducting this study due to concerns about the cumulative effects stemming from the multiple development projects that have, are, and may occur throughout the Territory. In conducting the study the JBACE will be better tooled to provide advice to the signatory parties regarding CEAs conducted during project-level EAs per Section 22 of the James Bay Northern Quebec Agreement (JBNQA).

1.1 Purpose and Scope

The study consists of three objectives, as follows:

i. Review and assess the instructions and guidance provided to proponents for the development of their CEAs.

ii. Determine how cumulative effects were addressed by the proponent in a sample of impact statements.

iii. Establish how the conclusions regarding cumulative effects in the impact statements influenced decisions regarding the projects.

Realizing the third objective of this study was not possible based on the information available to review, and would require interviews with the regulatory decision makers. No cause-effect, or influence, could be determined based on comparing the information contained in the impact statements and the project determinations and conditions. In its place, we conducted an analysis of the project determinations or authorizations to examine whether, and how, cumulative effects requirements or issues identified in the project directives and impact statements were reflected in the decisions and project conditions.

2. CUMULATIVE EFFECTS ASSESSMENT

Cumulative environmental effects are broadly defined as changes to the environment that are caused by an action in combination with other past, present and future actions. The notion of a cumulative environmental effect is based on the understanding that each individual disturbance or impact, regardless of its magnitude, can represent a high marginal cost to the environment. Fundamental to managing cumulative effects is thus recognizing that a significant adverse effect can result over time due to the culmination of individual, and even seemingly insignificant, actions (US Council on Environmental Quality 1996).

In principle, then, cumulative effects assessment is focused on an assessment of the condition of environmental receptors (and the nature and quality of relationships among them), and whether the total effects via all stressors in a project's regional environment are acceptable, including the potential additional stress caused by the proposed project (Canter and Ross 2010; Duinker and Greig 2006; Ross 1994). In undertaking such an assessment, project proponents are generally directed to consider the effects that are likely to result from their project in combination with other physical activities that have been or will be carried out.

Cumulative effects assessment has a long tradition of practice and research in Canada (CEARC 1988). The foundational principles of CEA were established in the 1980s, through the pioneering work of Beanlands and Duinker (1983), and expanded throughout the 1990s by scholars from diverse fields of science and practice. That said, CEA is also one of the most contested aspects of impact assessment – often the weapon of choice for those opposed to project development (Noble 2015). As CEA research and practice have evolved, a consistent theme has been the challenges to assessing and managing cumulative effects under regulatory, project-based assessment frameworks.

Several researchers and interest groups have pressed for more regional and strategic frameworks to assess and manage cumulative effects, and efforts are underway in some jurisdictions to advance such frameworks at regional or provincial scales – for example, regional assessment in the south Athabasca oil sands, and British Columbia's province-wide cumulative effects framework. However, in advancing such regional and strategic initiatives it is important not to lose sight of regulatory practice. Whilst advancing regional CEA initiatives is necessary, and will add value to current project-based assessments, proponents are still required, under existing regulatory frameworks, to assess the cumulative effects of their projects. Thus, what is practicable under project-based assessment, and what represents a reasonable standard of CEA practice for project proponents, needs further exploration and consideration by the research, regulatory and practitioner communities.

3. STUDY DESIGN

The project focused on a review of the directives (Quebec, federal), environmental impact statements (EISs), and decision documents (determinations, conditions) for seven EAs as identified by the JBACE (Table 1). The sample of EAs was not meant to be representative of EA practice; rather, the intent was to provide a cross-section of EAs such that preliminary observations could be made about the state of cumulative effects consideration and CEA practice in the James Bay region. The study consisted of three phases of review, each of which is described below.

Table 1. Projects included in the scope of the review

Project	Application Date	EA Directive(s) Issued	EIS Filing	Certificate of authorization / Decision
Eastmain 1-A Powerhouse and Rupert Diversion	2002	COMEV 2003 Federal 2004	2004	2006 Quebec 2007 Federal
Eleonore Gold Mine	2007	COMEV 2008	2010	2011 (2013*, 2014*, 2015*) Quebec
Bachelor Lake Gold Mine	2007	COMEV 2007	2011	2012 (2013*) Quebec
Matoush Uranium Exploration	2008	COMEV 2009 Federal 2009	2009	2012 Federal+
Renard Diamond Mine		COMEV 2010 Federal 2010 (2011*)	2011	2013 Federal 2014 Quebec
Extension of Route 167 N to the Otish Mountains		2010	2010	2011 Quebec 2012 Federal
Whabouchi Spodumene Mine	2011	2012	2013 (2014*, 2015*)	2015 Federal 2015 Quebec

* indicates amendments or modifications
+ no Quebec authorization issued for the project

3.1 Phase 1: Review of EIS Directives

Phase 1 focused on the scope of guidance provided in the EIS directives and whether the requirements (or directions) were sufficient to ensure good practice. Our review was based on a minimum set of good-practice criteria derived from the scholarly literature and CEA guidance documents, specifically whether the directive included a specific requirement or provision that the proponent:

- consider project effects/actions in combination with other past, present and future ones;
- consider biophysical and socioeconomic impact;
- consider natural disturbances as a cumulative effect;
- delineate spatial boundaries based on valued component[1] (VC) distribution or VC characteristics;
- identify certain priority VCs that the proponent should consider in CEA;
- identify limits or thresholds for VCs;
- identify or map features, impacts and other land uses in the baseline ;
- determine or establish trends or changes in VC condition over time;
- identify mitigation and / or monitoring to address the project's effects;
- identify mitigation and/or monitoring plans to address *cumulative effects*;
- describe those mitigation and / or monitoring measures; and
- identify monitoring indicators for each of the VCs that the proponent is directed to consider in its CEA.

3.2 Phase 2: Review of EISs

The second phase focused on an analysis of how cumulative effects were addressed by proponents in a sample of impact statements. The scope of this study did not support a comprehensive review of the entire EIS and supporting technical reports. A chapter-based review was undertaken. The CEA chapter, or chapter sections, of each impact statement was reviewed using a document content analysis approach (Creswell 2003) based on a set of guiding questions or review criteria. Attention focused, first, on the CEA chapter or section of the EIS. Then, for each VC identified in the CEA chapter or section, the scoping, baseline assessment and impact analysis and mitigation and monitoring sections of the EIS were reviewed. This information was then related back to the specific instructions or directions provided in the EIS directive, where applicable. Thus, our analysis focused only on those VCs or issues identified in the CEA chapter, and not on VCs or issues identified or addressed in other sections of the impact statement. For some VCs, we also referred to Provincial review committee (COMEX) and federal panel reports for further validation of our findings.

The review was guided by a set of evaluation criteria that establish good-practices in CEA and capture the scoping, retrospective, prospective, and management components of CEA (Noble 2015; Dube et al 2013; Gunn and Noble 2012; Baxter et al. 2001) (Table 2). These criteria were compiled by Aura, used in previous CEA reviews, and approved by the JBACE on 30 November 2015. The criteria capture what is considered 'good' CEA and represent what might be considered a reasonable standard of practice for project-based EA. The criteria were developed based on a review of multiple sources, including the federal *Cumulative Effects Assessment Practitioner's Guide* (Hegmann et al. 1999);

[1] Valued components (VCs) are aspects or features of the environment (biophysical or human) identified to be of importance by Aboriginal peoples, government agencies, project proponents or the public and that may be affected by a project, directly or indirectly. The importance placed on VCs may be scientific, ecological, cultural, economic, historical, archaeological or aesthetic in meaning.

draft technical guidance for CEA under the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012)[2]; scholarly research and guidance from the leading international journals on EA (*Environmental Impact Assessment Review, Impact Assessment and Project Appraisal, Journal of Environmental Assessment Policy and Management*); and publically available guidance on good practices in CEA in Canada (e.g. BC Forest Practices Board 2011; Beanlands and Duinker 1983).

It may not be possible to determine the extent to which all criteria are met using this approach, since it is possible that the project's effects on some VCs were sufficiently mitigated and therefore the VCs did not carry-forward to the cumulative effects analysis. Further, additional information may be contained in technical reports prepared to support the CEA that were not included or referred to in the EIS.

Table 2. CEA review criteria

Cumulative effects scoping	*Retrospective (baseline) assessment*
▪ CEA considers all types of stressors (projects, natural disturbances) that may affect VCs ▪ Physical/ecological and socioeconomic VCs included in CEA ▪ Rationale provided for CE VC selection ▪ CEA boundaries reflect natural distribution or patterns of VCs ▪ Past or existing development or disturbance included in CEA ▪ Future development or disturbance included in CEA	▪ Past and present conditions identified for each VC included in the CEA ▪ Baseline establishes trends in CE VCs and/or indicator condition change over time ▪ Baseline establishes relationships between CE VCs and/or indicator condition / change and key drivers ▪ CE VC thresholds (e.g. targets, limits, etc.) established in the baseline assessment
Prospective analysis (futures, predictions)	*Cumulative effects significance, management and follow-up*
▪ CE predictions, scenarios or conditions are identified for affected VCs or indicators ▪ Trends and linkages in baseline analysis used to inform future conditions or predictions ▪ Tools and techniques used are appropriate to capture / assess CEs and the uncertainties of future conditions ▪ Sufficient analysis / evidence is provided to support statements or conclusions about CEs ▪ CE predictions / assessment focuses on total effects on the VCs and the project's incremental contribution	▪ CEs / change assessed against benchmarks or a reference condition for the affected VC ▪ Thresholds, limits or regulatory targets used to assess CE significance ▪ Incremental CE contributions of the project are clearly identified ▪ Significance of CE is based on VC health or condition (vs. magnitude of the project's impact) ▪ Mitigation measures are identified for CEs ▪ Adaptive management measures are identified for CEs that are uncertain ▪ Monitoring or follow-up measures are identified for CEs

3.3 Phase 3: Review of Decision Documents

Phase 3 consisted of a review of project authorizations (recommendations and conditions) emerging from the EAs that relate to cumulative effects issues identified in either the terms of reference or the impact statements. The review of project authorizations, approvals or recommendations emerging from EA decision documents provided some insight to the consideration of cumulative effects issues in decision making processes, and the lifecycle of cumulative effects consideration from terms of reference to EIS to authorization.

[2] Although reference in this review is often made to the current technical guidance under CEAA 2012, the principles and guidance stated are similar to those that existed in the 1999 practitioner's guidance – pre-dating the first EIS included in the scope of this study.

3.4 Conceptual Framework

Results of our analysis are presented in four sections, commencing with a brief vertical analysis of the patterns we observed in the life cycle of the EAs with regard to cumulative effects consideration (Figure 1). The vertical analysis examined how the standards or expectations set out in the EIS directives flow through the EIS and, subsequently, the EA determinations. This is not intended to be an audit of how individual EAs perform against the stated directives – or whether they are deemed adequate assessments in terms of the specific issues and concerns that they were intended to address. The analysis and results presented are high-level observations. The vertical analysis is followed by three sections, each reporting on the three main objectives of this study, which focus on common issues or patterns identified across assessments, on a criterion-by-criterion basis, to provide a snapshot of the state of CEA practice including common strengths and limitations.

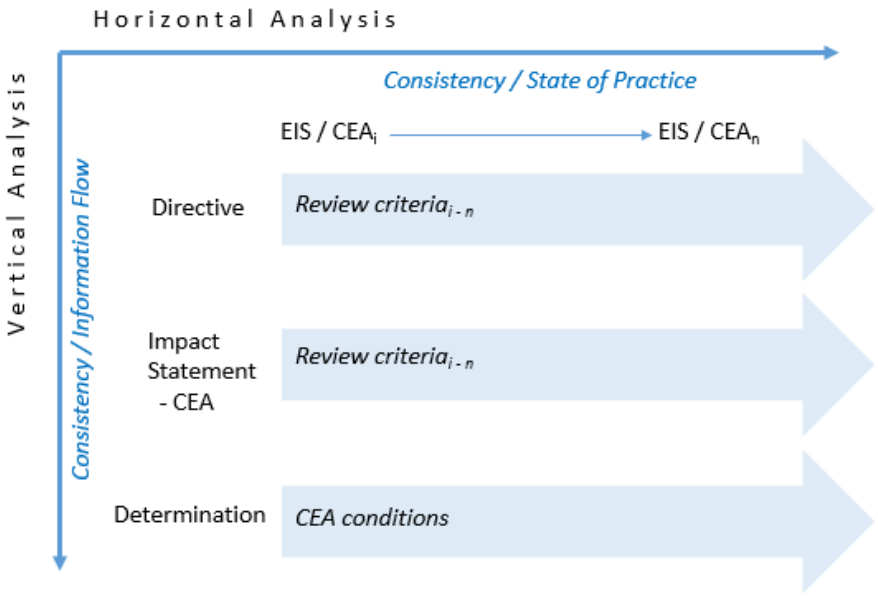

Figure 1. Conceptual framework for state of practice analysis

4. LIFECYCLE OF CUMULATIVE EFFECTS CONSIDERATIONS

A number of general observations emerged across the sample of EAs concerning cumulative effects consideration and treatment from directive, to EIS, to authorization. These observations illustrate macro issues regarding the cumulative effects life cycle over the course of the EA procedure.

- The scope and content of the CEA was determined in large part by the directives or terms of reference. The quality of CEA was thus, in large part, a reflection of the quality and scope of the instructions or expectations established in the directive. The EIS generally reflected what was set out in the directive, which we observed, in most cases, to adopt a narrow approach CEA.

- The directive(s) identified specific VCs to be included in CEA, and those VCs were typically considered by the proponent – but the proponent rarely exceeded the scope of the requirements.

- If the directive(s) did not require that the proponent explicitly address mitigation and monitoring programs for cumulative effects, such aspects were absent from the EIS.

- The directive(s) did not explicitly require that the proponent undertake an analysis of cumulative effects that is separate from the effects analysis for the project, and the EIS typically did not separate cumulative effects from project-specific effects.

- Explicit attention was given to data quality and evidence-based analysis in the directive(s) and this generally carried forward to the EIS and to the analysis of project-based impacts; however, such evidence-based analysis did not carry forward to the analysis of cumulative effects.

- The directive(s) asked for a description (including mapping) of current baseline conditions, but failed to require the analysis of trends in baseline conditions; the EIS baseline assessment thus presented current conditions, but did not consider trends in baseline conditions and changes in VC conditions over time.

- The directive(s) required the proponent to base their CEA on the conditions identified in their baseline assessments. The proponent adopted this practice, but the restrictive baseline assessment provided little information to support cumulative effects analysis.

- Requirements to identify limits or thresholds, when identified in the directive, typically carried forward to the EIS – but only for those VCs where guidelines are available (e.g. water or air quality guidelines); however, such limits or thresholds rarely carried forward to the assessment of the significance of cumulative effects.

- The panel report (where applicable) raised serious concerns about the quality of the CEA conducted by the proponent, especially concerns about the lack of evidence provided to support CEA and to substantiate the proponent's conclusions about cumulative effects. The report then proceeded to present conclusions of its own, typically that the project was not likely to cause adverse cumulative effects, but it made the same error as the proponent – providing limited or no analytical evidence to support the conclusion.

- The EA(s) tended to reflect an issues attention cycle that peaked with the panel report. The general pattern observed was as follows: the directive included a requirement for cumulative effects, but with minimal instruction; the proponent provided a weak assessment of cumulative effects, often unsubstantiated, but consistent with the directive; the panel report raised serious concerns about cumulative effects, but concluded they are not likely significant; the decision document or determination, including approval conditions, made no reference to cumulative effects.

- The flow of the consideration of cumulative effects was not easily discernible from the directive(s), to the EIS(s), to final decision(s). Cumulative effects are cited in the directive(s) and treated in the EIS(s), but rarely appear in post-EA conditions.

5. SECTION 22 EA DIRECTIVES

All of the Quebec directives included a requirement for the consideration of cumulative effects, but not all requirements were consistent with good-practice or served to ensure that the proponent did what was necessary to undertake a sufficient analysis of cumulative effects. Direction was usually provided in terms of what must be considered, but the directives were non-prescriptive in terms of how the proponent should approach the assessment of cumulative effects. Below we report our main findings from the sample of Quebec directives, followed by a comparison of Quebec to federal directives.

5.1 Basic Provisions and Requirements for Cumulative Effects Assessment

All seven of the section 22 EA directives made explicit reference to cumulative effects; five contained sections specifically addressing CEA requirements. The basic principle of CEA is that consideration be given to the project's effects in combination with those of other past, present and reasonably foreseeable actions or activities (Hegmann et al. 1999). The results show some variation in the scope, and perhaps understanding, of this basic CEA principle (Table 3). Two directives focused *only* on present and future considerations when providing direction on CEA; one directive (Bachelor Lake) focused *only* on the consideration of the project's effects in combination with other existing infrastructure in the project's environment – primarily infrastructure associated with the project itself.

Table 3. Section 22 EA directive basic CEA provisions and requirements

CEA requirements	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Spodumene Mine
The CEA must consider project effects/actions in combination with other past, present and future ones	Past Present Future	Present Future	Present	Present Future	Past Present Future	Past Present Future	Past Present Future
The CEA must consider biophysical and socioeconomic impacts	✓	✓	✓	✓	✓	✓	✓
The CEA must consider natural disturbances as a cumulative effect	✓ [burn sites]			✓ [burn sites]			

One project (Eastmain 1-A), the oldest directive included in the sample, provided specific guidance to the proponent in terms of the expected timeframes that define past and reasonably foreseeable future considerations – noting an expected 30-year time horizon for the consideration of previous disturbances and a 10-year future projection. This is not common-practice – usually the temporal scope of the CEA is determined by the proponent; however, setting *minimum* timeframes does provide the proponent with much clearer direction as to CEA expectations. The specificity in this particular case is likely a reflection of the history of Hydro Quebec operating in the region and the availability of supporting data and project development plans within the hydroelectric sector, and a reflection of public concerns relating to the cumulative effects of multiple developments in the project area[3].

[3] The Eastmain 1-A EIS directive was prepared under an EA coordination agreement between Québec, the Canadian Environmental Assessment Agency and the Cree Regional Authority, providing for a single set of directives. Draft directives were posted for public consultation, resulting in final directives for the project that incorporated public input in the final instructions to the proponent. The terms of reference prepared for federal review panel, by the Canadian Environmental Assessment Agency, were similarly subject to public consultation prior to being issued.

All section 22 directives consistently required that the proponent include both biophysical/ environmental and socioeconomic/cultural components and effects within the scope of its CEA. This is an important requirement, as much of the scholarly literature, and analyses of practice elsewhere, indicates that socioeconomic and cultural factors are given significantly less consideration than biophysical or environmental factors when assessing the potential cumulative effects of development actions (Weber et al. 2012; Parkins 2011; Callahan and Sector 2007; Olsson et al. 2004).

Requirements for the consideration of natural disturbances as a potential cumulative effect were not consistent across section 22 directives. Only two directives specified that natural disturbances be considered, with specific reference to burn sites. Whether a proponent should be required to consider all types of natural disturbances (or disasters), such as severe flood events or forest fires, as part of their CEA, or whether such considerations are part of a broader risk assessment, is often the subject of debate. However, there is a general expectation in CEA that proponents do consider those known natural disturbances (e.g. burn sites / burn areas) that may affect the same VCs that are affected by their project's actions. The sample of directives examined was relatively weak in this regard. The consideration of potential project interactions with natural perturbations is identified in the current Canadian Environmental Assessment Agency's technical guidance for assessing cumulative effects as a practice in need of improvement (CEAA 2014).

5.2 Instructions for Scoping the CEA and EA Baseline Assessment

Requirements varied concerning the scope of CEA, and for EIS baseline assessment (Table 4). Exceptions were guidance for setting the project's assessment boundaries, and expectations regarding descriptions of current baseline conditions, which were reasonably consistent across directives. For example, in all but one section 22 directive the proponent is instructed to identify assessment boundaries that capture the distribution or features of the VCs or land uses of concern, and that capture both the project's direct and indirect effects. All directives required the proponent to describe current baseline conditions and land uses in the project's environment and, where applicable, to map the distribution of such features.

A third area of reasonable consistency was guidance on VC selection. The identification of common VCs in project directives or terms of reference is important to developing a regional understanding of changes in, and potential cumulative effects to, the baseline conditions of core VCs over time – thus allowing for improved project-based and regional understanding of cumulative effects. Ball et al. (2013), for example, suggest that in any development region there is a need for regulatory or oversight authorities, or land use planning agencies, to determine a minimum set of priority VCs (and indicators) that are to be included in every impact assessment. We observed that five of the directives identify specific VCs that the proponent should consider in their CEA, and do so with some degree of consistency across directives.

For example, the Eastmain 1-A, Matoush, Renard, Route 167 North, and Whabouchi directives all require that the proponent consider in their CEA, at a minimum:

- land use by the Crees
- socioeconomic conditions
- wildlife habitat (terrestrial, aquatic)
- endangered plant and animal species
- wildlife (terrestrial, aquatic)
- recreation and tourism (sport hunting/fishing)

Table 4. Section 22 EA directive guidance to support CEA scoping and EA baseline assessment

Direction or guidance provided to support CEA	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Spodumene Mine
Requires that spatial boundaries are based on VC distribution or VC characteristics	✓		✓	✓	✓	✓	✓
Identifies certain priority VCs that the proponent should consider in CEA	✓			✓	✓	✓	✓
Requires the identification of limits or thresholds for VCs			✓	✓	✓		✓
Requires the baseline to identify or map features, impacts and other land uses	✓	✓	✓	✓	✓	✓	✓
Requires the baseline to determine or establish trends or changes in VC condition over time	✓						

The most recent of these four directives (Matoush, Renard, Route 167 North, and Whabouchi) provide nearly identical instruction, suggesting that some degree of consistency may have been achieved in recent years in terms of the priority VCs for consideration in CEA in the James Bay territory. In the case of the Eastmain 1-A, the same types of VCs were identified but the directive also contained more context-specific instructions in terms of VC inclusion – requiring also the consideration of the number of water bodies with mercury concentrations in fish, and requiring specific wildlife species to be assessed – including woodland caribou, harlequin duck and migratory birds. The Eastmain 1-A directive also required that the proponent consider the quality of life and health of the Crees, and the transmission and usefulness of Cree traditional knowledge related to the rivers of the Territory following the diversion of several rivers in the last 30 years. This detail may be attributed, in part, to the history of Hydro Quebec operating in the region and existing data on the nature and types of impacts and issues of concern emerging from previous operations.

Four of the section 22 directives required the proponent to identify relevant thresholds for VCs or baseline conditions – these were mostly the more recent directives. Information collected from baseline studies is of limited value for CEA unless it can be compared to some form of benchmark, target or threshold (Dube et al. 2013). These may be response or effects-based thresholds (e.g. water quality parameters, species population levels) or stress-based thresholds (e.g. minimum habitat requirements) that are directly correlated to VC condition. Stress-based thresholds focused on project-based stress, such as an emission standard or effluent discharge rate, and are of value to mitigating the effects of a project but are of limited value to understanding or assessing cumulative effects to, or changes in, VC conditions.

In the four directives that required the specification of thresholds, emphasis was consistently placed on the determination of thresholds to aid in understanding of VC conditions, thus providing useful guidance for assessing and understanding the significance of potential cumulative effects. For example:

- *Bachelor Lake directive*: The proponent is encouraged to establish acceptability thresholds or levels for understanding the intensity or significance of effects (sec. 4) and irreversibility thresholds for impacts on the biophysical environment (sec. 4.1).

- *Matoush directive*: The proponent is required to establish thresholds or levels of acceptability when assessing impacts, including cumulative impacts (sec. 3.5).

- *Renard directive*: The proponent is required to determine irreversibility thresholds for all impacts assessed in the EIS (pg. 16).

- *Whabouchi directive*: The proponent is required to determine irreversibility thresholds for all impacts assessed in the EIS (pg. 13).

A limitation observed across all but one directive was the focus on requiring the proponent to describe and map current conditions in the project's environment, but with no requirement to also identify past conditions, establish trends, and discern, where possible, potential relationships between drivers of change and observed changes in baseline VC conditions. For example, the section 22 directive for the Eleonore gold mine project requires the proponent to "describe the state of the environment as it occurs in the study area before the project… Using both qualitative and quantitative inventories, it should describe in the most factual way possible components of the biophysical and human environments likely to be affected by the project." There is no requirement to examine past conditions or changes over time. Similarly, for the Renard project, the proponent is directed to describe current use and planned use in the project area, but not to consider past use and how use has changed over time, or how changes in use have affected VC conditions.

In most all cases the directives did *not* instruct the proponent to conduct a baseline assessment that would support good CEA. The appropriate scope for considering the significance of cumulative effects is that time in the past when a VC was most abundant or less disturbed – this requires the consideration of past conditions and a retrospective assessment (McCold and Saulsbury 1996). A requirement should exist in any CEA directive that the proponent identify changes in VC conditions over time (e.g. caribou populations, habitat metrics, water quality), and where possible identify the main drivers of this change (e.g. land uses or patterns), in order to establish the trends, knowledge base and understanding necessary to predict and appropriately assess the significance of a project's potential cumulative impacts (Noble 2015b)[4].

Eastmain 1-A was the only directive to explicitly require that, with respect to baseline information, the proponent "ensure a sufficient time-depth of data and information to establish averages, trends and extremes." For biophysical issues, the proponent is directed to approach the baseline assessment using an ecosystemic approach (sec. 8.1), to characterize affected components and, where relevant, describe

[4] The good-practice criteria adopted in this review for scoping and retrospective analysis suggest that baseline studies to support CEA must consider *past conditions and disturbances*, and also assess *changes in VC condition over time* in the project's study area. In some instances, however, as was the case for certain projects included in the scope of this review, a project is proposed in a region that has not been previously developed. Proponents may rely on traditional knowledge or other sources of information (e.g. research reports) to better understand past conditions and disturbances (natural or anthropogenic), and to identify potential thresholds or limits of change, but data to populate models for spatial or temporal analysis of cumulative effects may be limited. It may then be reasonable that a project directive, and the proponent's EIS, place greater emphasis on the assessment of *current baseline conditions* as the *benchmark* against which change is assessed and monitored. This does limit the ability to carry out a proper CEA for the project in advance of its approval. It also means that strong directives for, and commitments to, ambient environmental monitoring before, during, and after project development are needed to assess cumulative change and to ensure that sufficient data are available for the CEA of future developments in the region.

the trends or extremes over time – including an explanation of the relations and interactions between various components of the environment (sec. 8.1). The directive further requires, with respect to the socioeconomic baseline (e.g. social cohesion, cultural environment, employment) that the proponent "measure transformations or continuities over the last 30 years" (sec. 9.4) and "identify the factors, including historical context" that help explain current baseline conditions (sec. 9.1, 9.2, 9.4).

5.3 Instructions for the Analysis or Prediction of Cumulative Effects

All section 22 directives required that the proponent explain and justify the methods used to predict potential impacts of the project on the environment, including uncertainties, in their EIS. Although not specific to CEA, this is good practice.

Limited direction is provided in terms of *how* the proponent is to carry out its CEA. The common guidance presented in the directives, regarding impact prediction in general, is that the proponent is to identify and assess impact in relation to the 'description of the environment' section of the EIS. However, as noted above, the direction provided for the 'description of the environment' (i.e. baseline) is focused on describing and mapping current conditions, and not on identifying VC condition changes or trends to support CEA and analysis.

Three directives do provide some guidance for impact assessment or analysis, though the guidance is limited and focused more on issues that the proponent should consider as opposed to CEA guidance per se:

- *Matoush directive*: The proponent is directed to determine cumulative impacts "based on literature dealing with similar projects carried out elsewhere in Canada or around the world."

- *Eleonore directive*: There is a general requirement, not specific to CEA, that the proponent consider comparable projects carried out in northern Québec, and especially the experience that it acquired during the exploration phase of the project (sec. 2.5).

- *Renard directive*: Regarding social impacts, the proponent is specifically directed to consider other projects of a similar nature carried out in Northern Québec. The proponent is also directed to describe the effects that opening up new areas under the project will have on the introduction of other resource development projects; however, this is *not* a requirement of the CEA.

5.4 Specification of Cumulative Effects Management or Monitoring Requirements

Cumulative effects mitigation and monitoring requirements were found to be weak across the sample of directives (Table 5). Only one directive, Eastmain 1-A, contained a specific requirement for the mitigation and monitoring / follow-up of potential cumulative effects – even though *all* directives required that cumulative effects be considered in the assessment.

The Eastmain 1-A directive, the earliest of the sample reviewed, demonstrates a number of elements of *good-practice* in terms of setting the appropriate standards for CEA mitigation and monitoring – standards missing from the other directives. For example, the Eastmain 1-A directive requires that the proponent:

- describe mitigation measures for cumulative effects, including the significance of cumulative effects and, where appropriate, compensation measures (sec. 10.2).

- evaluate the effectiveness of measures applied to mitigate cumulative impacts (sec 10.2).

- address efforts to work with other proponents / parties to ensure the management of cumulative effects over the long-term and provide a summary of the discussions that took place.

- consider the need for a follow-up program to verify the accuracy of the assessment or to dispel the uncertainty concerning the assessment of cumulative impacts.

Table 5. Section 22 EA directive guidance for cumulative effects management and monitoring

Mitigation and monitoring / follow-up directives	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Spodumene Mine
Specific requirement to identify mitigation and/or monitoring plans to address *cumulative effects*	✓						
General requirement for mitigation and / or monitoring to address the project's effects	✓	✓	✓	✓	✓	✓	✓
General requirement that mitigation and / or monitoring to address the project's effects are described	✓	✓	✓	✓	✓	✓	✓
Identifies monitoring indicators for each of the VCs that the proponent is directed to consider in its CEA							

The only other directive that makes some reference to cumulative effects mitigation is the Eleonore project, where the proponent is instructed to consider cumulative impacts and mitigation within the context of the La Grande and Eastmain 1-A hydroelectric projects.

All directives included a general requirement for mitigation and monitoring / follow-up as part of the EIS requirements. Further, all directives required that the proponent specify the frequency and sampling methods to be used for monitoring, and the specific parameters to be analyzed. However, no specific indicators are identified to direct the proponent on what to monitor (or assess) for the specific VCs that were prescribed in the directives (e.g. land use by Crees, wildlife habitat, outdoor recreation) as required in the CEA.

If the directives identify common VCs, as is the case for five of the directives in the sample, it is important to also provide direction on the nature or types of indicators to be used for assessing cumulative impacts to those VCs, and in the design and implementation of monitoring programs. This

will provide a common approach to assessing those priority VCs, and to monitoring regional change in their conditions over time and across space in the James Bay Territory.

5.5 Scope of Federal Directives or Terms of Reference for Cumulative Effects

The sample of federal directives or guidelines reviewed (Table 6) was too small to draw meaningful conclusions. Comparing the sample of section 22 directives to federal directives was also difficult, given that CEA under the federal Act is guided, in part, by separate practitioner guidance (Hegmann et al. 1999; CEA Act 2014) and by the Canadian Environmental Assessment Agency's Operational Policy Statement (OPS) on CEA under the 1992 and 2012 environmental assessment acts. As such, the federal directives or terms of reference contain few details on the specific approach to CEA – it is implicit that the proponent consult the OPS and relevant CEA guidance provided by the Agency. The OPS, and practitioner / technical guidance, provide considerably more detail on the CEA approach and expectations than the section 22 directives.

The four federal directives included in the sample were also quite different in their scope and intent. For the Whabouchi project (prepared under CEAA 2012), for example, the stated purpose of the directive / guidelines is to "…identify for the proponent the information requirements for the preparation of an Environmental Impact Statement… [including] the nature, scope and extent of the information required" (EIS guidelines, pg. 1). Specific instruction is then provided on how to go about assessing effects, and the matrices to be used for presenting assessment results; however, limited direction is provided for CEA. The proponent is directed to the Agency's OPS and technical guidance for CEA.

In contrast, the stated purpose of the federal guidance provided for the Route 167 project, under the former Act, is "to initiate public participation in the comprehensive study process under the Canadian Environmental Assessment Act (the Act)… [and] briefly describes the federal environmental assessment process, the various opportunities for public participation and the proposed scope of the federal environmental assessment of the project." Few details are provided on the required EIS content and approach, and only general reference is made to CEA requirements. The (assumed) expectation is that the CEA is conducted based on the OPS and guidance contained in the practitioner's guide (Hegmann et al. 1999). Guidance for the Renard project, also under the former Act, is intended to "provide the proponent with the necessary information to prepare an environmental impact statement (EIS)…, which will be assessed through a comprehensive study process in accordance with the Act" (EIS guidelines, pg. 1).

Although the Eastmain 1-A project was subject to the Canadian Environmental Assessment Act, a single, joint directive was issued for the preparation of the EIS – by way of an administrative agreement signed between the Government of Québec, the Canadian Environmental Assessment Agency and the Cree Regional Authority. The results of our analysis of the Eastmain 1-A federal directive are thus similar to the results of our analysis of the Section 22 directive. The sole federal directive issued was with respect to the terms of reference for the Federal Review Panel, providing instruction for carrying out its public review process. However, it too was prepared taking into account the administrative agreement.

That said, there are some important differences between the sample of federal project guidelines and section 22 directives:

- The federal directives consistently scoped CEA as requiring the consideration of past, present and reasonably foreseeable effects or actions, in combination with the effects of the proposed

project. The section 22 directives were less consistent in this regard, with only 4 of the 7 directives requiring the consideration of past, present and future actions.

- The extent to which natural disturbances was a required consideration in CEA under the section 22 directives varied, but such a requirement was absent from all federal directives / guidelines with the exception of the Eastmain 1-A directive, which was prepared jointly by COMEV and the Canadian Environmental Assessment Agency. The limited scope of the federal directives is not surprising, since the focus under the federal Act in terms of natural disturbances is on the effects of natural disturbances or hazards on the project. For example, for the Whabouchi project: "The EIS will take into account how local conditions and natural hazards, such as severe and/or extreme weather conditions and external events…could adversely affect the project and how this in turn could result in impacts to the environment (e.g. extreme environmental conditions result in malfunctions and accidental events)" (sec. 7.1.3). The focus is *not* on how the project's effects may interact, cumulatively, with natural disturbances and cause potentially adverse impacts on VCs.

- Four of the section 22 directives required that the proponent specify thresholds for VCs to assist in effects assessment – an important aspect of determining the significance of potential cumulative effects (Dube et al. 2013; Beanlands and Duinker 1986). A similar requirement was missing from the federal directives, aside from encouraging the proponent to refer to relevant guidelines and standards where they might exist.

- Both the section 22 and federal directives / terms of reference were weak on requiring that the proponent identify trends or changes in baseline conditions over time, so as to support evidence-based CEA. However, it may be that the federal directives / terms of reference are relying on accompanying practitioner / technical guidance (e.g. Hegmann et al. 1999) to provide such direction. Aside from the Eastmain 1-A (joint directive), only the Whabouchi guidance, developed under CEAA 2012, made explicit reference to change assessment.

- Section 22 directives provided for a much broader scope in terms of capturing both biophysical and socioeconomic cumulative effects. Requirements for the assessment of cumulative socioeconomic effects under the federal directives were constrained, given the definition of an 'environmental effect' under the Act. For example, in the Route 167 federal terms of reference, it is stated: "the social effects related to the construction of the new road on the territory can't be addressed under the Act" (pg. 9). The only exception was Eastmain 1-A.

- All section 22 directives required that the proponent explain and justify the methods used to predict potential impacts of the project on the environment, including uncertainties, in their EIS. Though not explicit to CEA, this is a general requirement of the EIS. With the exception of Eastmain 1-A, this requirement was missing from the federal directives; however, it is a noted element of good practice in federal CEA practitioner guidance (CEAA 2014; Hegmann et al. 1999). That said, based on our analysis of the EISs (see sec. 6.3), proponents generally failed to justify their CEA methods or provide analytical support across most all VCs assessed.

Table 6. Analysis of provisions and requirements for CEA under federal project EA directives / terms of reference

	Eastmain 1-A[1]	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Spodumene Mine
Basic CEA requirements				
The CEA must consider project effects/actions in combination with other past, present and future ones	Past Present Future	Past Present Future	Past Present Future	Past Present Future
The CEA must consider biophysical and socioeconomic impacts	✓[1]	[2]	[2]	[2]
The CEA must consider natural disturbances as a cumulative effect	✓ [burn sites][1]			
Direction or guidance provided to support CEA				
Requires that spatial boundaries are based on VC distribution or VC characteristics	✓	✓	✓	✓
Identifies certain priority VCs that the proponent should consider in CEA	✓	✓	✓	✓[3]
Requires the identification of limits or thresholds for VCs				
Requires the baseline to identify or map features, impacts and other land uses	✓	✓		✓
Requires the baseline to determine or establish trends or changes in VC condition over time	✓			✓
Instruction regarding the analysis or prediction of CEs				
Proponent must identify and justify methods used to predict CEs	✓			
Direction provided in terms of *how* to carry out the CEA	[4]	[4]	[4]	[4]
Mitigation and monitoring / follow-up directives				
Specific requirement to identify mitigation and/or monitoring plans to address *cumulative effects*	✓			✓
General requirement for mitigation and / or monitoring to address the project's effects	✓	✓	✓	✓
General requirement that mitigation and / or monitoring to address the project's effects are described	✓	✓	✓	✓
Identifies monitoring indicators for each of the VCs that the proponent is directed to consider in its CEA				

[1]The directive reviewed for the Eastmain 1-A project was a joint directive between COMEV and the Canadian Environmental Assessment Agency. The scope of factors considered captures the requirements of *both* the CEAA and Section 22.
[2]Effects to Aboriginal peoples, or if the effects are caused due to a change in biophysical conditions, as specified under the current and former federal EA Acts. Other socioeconomic impacts are not within the scope of the Act.
[3]Implicit requirement given the assessment is subject to CEAA 2012, which makes specific reference to matters / VCs under federal jurisdiction, and to specific effects to Aboriginal peoples.
[4]For CEAs conducted under CEAA 2012, and under the former federal Act, it is implicit that the assessment adopt the principles the CEAA Operational Policy Statement, and refer to the Cumulative Effects Practitioner Guide (former Act) and Technical Guidance for the Assessment of Cumulative Effects (current Act). These guidelines, or specific instructions, are often not included in the project-specific directives or terms of reference.

6. CONSIDERATION OF CUMULATIVE EFFECTS IN THE ENVIRONMENTAL IMPACT STATEMENTS

We observed considerable variability in the consideration of cumulative effects. Across the EISs we found cumulative effects to be given only minimal attention, and subject to limited analysis. Evidence supporting conclusions about cumulative effects, when such effects were considered, was weak or absent from the EISs for many VC cumulative impact statements. The conclusions regarding cumulative effects to VCs were difficult to discern across all of the projects. Below we report our main findings from the samples of EISs. We do not venture explanations as to *why* certain practices or approaches were adopted (e.g. why baseline data or trends were not established, or why certain tools or techniques were

used and not others), as such information cannot be easily discerned from an analysis of EIS documentation.

6.1 Scoping Practices

Scoping for CEA requires consideration of the VCs potentially subject to cumulative effects in the project's regional environment, and the consideration of other activities potentially affecting those VCs (Baxter et al. 2014). In most of the EISs, the scope set out for the CEA included the consideration of the project and other projects and activities in the project's regional environment (Table 7). Some assessments were restrictive in their scope. For example, the Matoush EIS considered only projects but no other types of land uses; the Eleonore EIS considered projects and then provided a list of projects that were excluded from the CEA due to the EA's (restrictive) spatial and temporal bounds; whereas the Bachelor Lake EIS identified other projects and activities (e.g. forestry, telecommunications) but contained no CEA analysis.

Natural disturbance is an important scoping consideration when assessing cumulative effects, especially when attempting to understand baseline changes over time and current and future threats to VC condition or sustainability (Baxter et al. 2001; CEAA 2014). The requirement to consider natural disturbances appeared only in the Eastmain 1-A and the Matoush section 22 project directives, of which only the Eastmain 1-A project EIS made explicit reference to natural disturbances in its CEA. The Renard EIS was the only other to make explicit reference to natural disturbances as a source or driver of potential cumulative change.

All section 22 directives required that the proponent include both biophysical/environmental and socioeconomic/cultural components and effects within the scope of their CEA. Across the seven projects there were 15 groups of VCs (34 VCs total) identified in the CEA sections or chapters of the EISs, of which 3 groups of VCs (10 VCs total) were socioeconomic. Two of the EISs did *not* include socioeconomic VCs in the assessment of cumulative effects. For those EISs that *did* include socioeconomic VCs in the CEA, land use by the Crees (access, hunting, trapping, and fishing) was consistently considered, followed by socioeconomic conditions (employment, economic opportunity) (Table 8).

A clear rationale for the selection of VCs included in CEA was provided only in four of the seven EISs. The Eastmain 1-A identified only 3 VCs for inclusion in its CEA, but they were selected based on a clearly defined set of criteria that were applied to the full set of EIS VCs, which included: (i) it must be possible to assess cumulative effects on the component resulting from the combination or interaction, over time, of direct or indirect impacts arising from a number of interventions; (ii) it must be possible to measure or anticipate cumulative affects over a large territory and a long period of time; and (iii) reliable data must exist on the component from the past 30 years. It was outside the scope of our analysis to determine whether these criteria were reasonable or whether they excluded VCs that were already approaching critical limits or at high risk of potentially adverse cumulative effects in absence of the project.

Cumulative effects did not emerge in the EISs as a key criterion in scoping, or in VC selection. However, in most cases, with regard to spatial bounding, cumulative effects was an implicit consideration. VC-based scoping was typically used in the EISs - the assessment boundaries were established based on the distribution or spatial pattern of the VCs of concern – this is good-practice (Beanlands and Duinker 1986). There were, however, two exceptions: the Bachelor Lake EIS, which did not delineate CEA for VCs, and the Route 167 EIS. In the case of the Route 167 EIS, the baseline scoping section identified a

300 km-wide corridor, including borrow pits located beyond the 300 km-wide corridor, as a boundary that has “been delineated in a way to include the valued environmental components and to show the direct and indirect effects of the selected project” (EIS, pg. 27). The boundary for the CEA, however, appears to be narrowed to a 70 km-wide corridor, based on the location of disturbances (i.e. the location of the project and of other activities in the region) (EIS, pg. 312), versus based on the distribution of the affected VCs.

Table 7. Cumulative effects scoping practices in the sample of EISs[5]

Review criteria	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Project	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Mine
CEA considers all types of stressors (projects, natural disturbances) that may affect VCs	Projects, river system modification, roads, power lines, fires, sport hunting and fishing.	Projects; list of other projects also identified that are *excluded* from the CEA due to spatial and temporal bounds.	No specific CEA in the EIS; but reference made to other projects including forestry, mining, and tele-communication.	Projects.	Projects, forest development, traditional Native activities, fires.	Projects, forestry.	Projects, land uses, protected spaces, wildlife management plans.
Physical/ ecological and socioeconomic VCs included in CEA	Mercury in fish and consumption of fish, Cree hunting, fishing and trapping, and recreational navigation.	Surface water quality, fish and fish habitat, land and resource use, socioeconomic aspects.	No specific CEA VCs identified in the EIS.	Vegetation, wildlife, water quality.	Air quality, soil quality, groundwater, surface water, aquatic fauna, terrestrial wildlife and habitats, vegetation and wetlands, socioeconomic conditions, land uses.	Conflicting lists of VCs – a list of 10 VCs retained, followed by a list of 6 VCs identified as final: wetlands, caribou, moose, employment, Cree land use.	Air quality, noise, water quality, fish and fish habitat, woodland caribou, little brown bat, land use (hunting, fishing, trapping), socioeconomics.
Rationale provided for CE VC selection	Project directive, community value, possible to measure cumulative impact, available data, etc.	Yes – based on stakeholder concerns, EISs for similar project, and MDDEP directives.	No specific CEA VCs identified in the EIS.	Yes – VCs susceptible to residual effects and affected by other past, present and future projects.	No clearly defined rationale; appears to be based on key issues and concerns during consultations.	No clear explanation or rationale found.	Yes – residual effects; values and concerns voiced during project consultation
CEA boundaries reflect natural distribution or patterns of VCs	Yes, based on VCs and Municipalité de Baie James territory.	Yes, based on VC distribution (but temporal scope is restrictive).	No specific CEA VCs identified in the EIS.	Boundaries set within a 100km radius of the project, but no VC-by-VC boundaries.	Boundaries vary based on VCs considered.	Boundaries based on disturbance (70 km corridor) vs the VCs.	Local study area; regional study area – defined by VCs of concern.
Past or existing development or disturbance included in CEA	Includes hydro, fire, river modification, roads, power lines, hunting/fishing.	Includes hydro, transmission lines, mining.	No specific CEA section of chapter in the EIS.	Includes mining exploration projects, major road, and landfill.	Includes mining, forestry, traditional use, fires, etc.	Mining, exploration, logging activity.	Includes roads, power stations, other mines, power lines.
Future development or disturbance included in CEA	None specified.	Includes mining, permanent camps.	No specific CEA section of chapter in the EIS.	National park, and proposed Route 167 extension.	Includes mining, logging, road work, powerlines, generating stations, recreation and tourism, etc.	Mining, logging, outfitting operations, park establishment.	Includes other mining activities, outfitting, protected area activities and reserves.

[5] Green indicates that the review criterion has been satisfied. Yellow indicates that the review criterion has been partially satisfied. Red indicates that the review criterion has not been satisfied.

Table 8. Valued components by type / group identified in the CEA sections or chapters of the EISs

	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Spodumene Mine
Biophysical VCs	mercury in fish						
		water quality		water quality	water quality		water quality
					water quantity		
					groundwater quantity		
					groundwater quality		
		fish and fish habitat			fish and fish habitat		fish and fish habitat
				terrestrial wildlife (e.g. moose, bear) and habitat	terrestrial wildlife (e.g. caribou, moose) and habitat	terrestrial wildlife (e.g. caribou; moose) and habitat	terrestrial wildlife (e.g. caribou; little brown bat) and habitat
					birds, waterfowl and habitat		
					air quality		air quality
				vegetation	Vegetation		
					Wetlands	wetlands	
					soil quality and integrity		
							noise
Socioeconomic VCs	Cree land use (e.g. hunting, fishing, trapping)	Cree land use (e.g. hunting, fishing, trapping)			Cree land use (e.g. hunting, fishing, trapping)	Cree land use (e.g. hunting, fishing, trapping)	Cree land use (e.g. hunting, fishing, trapping)
		socioeconomic conditions (e.g. employment)			socioeconomic conditions (e.g. employment)	socioeconomic conditions (e.g. employment)	socioeconomic conditions (e.g. employment)
	recreational navigation (e.g. canoeing)						

6.2 Retrospective Analysis

> "*[Cumulative effects assessments] are often more involved than assessments of direct impacts. A likely reason that cumulative impacts are not addressed more effectively is that they are not considered early enough in the assessment process*" (McCold and Holman 1995).

A good baseline assessment to support the analysis of cumulative effects consists of the identification and analysis of conditions over space and time for the purpose of delineating change, trends, patterns, or limits to assist in cumulative impact assessment, evaluation, and monitoring activities (Noble 2015b). However, in cases where VCs or indicators are not amenable to change assessment or trends analysis, information on past conditions can be used alongside information on current conditions as limits or benchmarks against which cumulative effects can be assessed.

Our analysis of the baseline assessments in the sample of EISs focused *only* on those VCs that were identified and assessed in the cumulative effects chapter or section(s) of the EIS. We found that the baseline assessments across the sample of the EISs reviewed largely reflected what was asked for in the EIS directives: a descriptive approach, focused primarily on describing current VC conditions, mapping VC locations or distributions, and identifying potential sources or drivers of change in the project's local to regional environment (Table 9).

For most VCs, only the present conditions or current baseline was described. The Whabouchi EIS set an ambitious baseline of 1975, as the year against which change and impacts would be assessed; however, for the cumulative effects VCs we examined, no 1975 baseline condition was actually described in the EIS. The only exception was the VC land use, for which some qualitative descriptions of past land use and access were presented. We observed similar practices across most cumulative effects VCs; no previous disturbance of past baseline conditions were described. The only exceptions were for select socioeconomic VC indicators, namely human / community population demographics, where quantitative analyses were often presented and changes identified from past to present. The Eastmain 1-A EIS was an exception to the practice observed; past disturbance conditions and condition changes from past to present were identified in the baseline assessment for each of the VCs included in the CEA.

The identification of trends (and spatial patters) in the baseline assessment of a project, even if only general or qualitative in nature (e.g. VC condition improving or worsening), is important to supporting good CEA. Baseline assessments need to measure, or qualify, changes in VC conditions over time and / or across space relative to a reference state (temporal or spatial). These changes can then be related to key pressures or development actions (e.g. burns, disturbances, access changes, etc.) and the relationships, even if qualitative associations, used to assist in cumulative effects predictions and assessments (Dube et al. 2013).

We found that trends or patterns typically were not identified to support extrapolation for the purpose of supporting CEA; and only for a limited number of VCs (namely water quality) were spatial reference points identified to support the monitoring of cumulative change in the future. It may be because the data were unreliable in many instances, or simply not available in some project regions where the development is proposed in a relatively undisturbed environment. When trends were identified, however, specifically for land use and access, they were most often qualitative in nature but still provided only limited information to assess potential cumulative change.

Collection of assessment data and information is of limited value unless that information is compared to some form of a benchmark or target when cumulative effects are assessed (Noble 2015b; Dube et al. 2013). No thresholds were found in the Bachelor Lake EIS for cumulative effect VCs, even though the section 22 EIS directive for the project directed to the proponent to establish acceptability thresholds or limits for understanding the intensity and significance of effects. Similarly, no thresholds or limits were found for cumulative effect VCs in the Route 167 EIS.

When thresholds were identified for cumulative effects VCs, they were typically those thresholds or limits defined in regulatory standards or guidance – for example: provincial air quality and water quality standards, or Canadian Council of Ministers of the Environment (CCME) guidelines for aquatic health. In other instances, the thresholds identified were associated with the project's stress or emissions, but not the affected VC. For example, in the Eleonore project several thresholds or standards are identified for emissions/effluent discharge, and used to calculate potential risks to aquatic systems due to estimated concentrations of major elements in mine effluent (EIS pg. 3-27, Table 4.2.1, Table 8.3-4). These observations are consistent with analyses of CEA practice in other regions, where the thresholds identified are typically only those associated with nationally recognized guidelines (e.g. CCME) or punitive legislation (Ball et al. 2013).

For other VCs, there is little to no reference to thresholds or limits to aid in subsequent effects-based analysis. In the Route 167 project, concerning the project's residual impacts on Woodland caribou, attention is focused on describing why thresholds cannot be established for the VC: "Scientific research on thresholds in relation to the Woodland caribou is still at an early stage, but clearly shows sensitivity to anthropogenic disturbances….predicting how and to what degree the Woodland caribou will be affected by this project is risky or even impossible. Consequently, the significance of the impact on this component cannot be evaluated" (EIS, pg. 277-278). The focus of attention was specific to the project's effect, and not to the cumulative effects to Woodland caribou habitat in the region – which could be explored using a risk-based model to examine cumulative habitat loss and various landscape fragmentation metrics to model potential species responses.

Table 9. Retrospective (baseline) analysis of cumulative effects in the sample of EISs[6,7]

Review criteria	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Mine
Past and present conditions identified for each VC included in the CEA	Baseline analysis for each VC identified past and present conditions and effects, including pre-disturbance conditions and levels for mercury.	Emphasis placed on describing current conditions only for biophysical VCs. Some historical context and data presented for socio-economic VCs, including condition change over time.	There is no CEA in the EIS, and no CE VCs identified for analysis beyond the project's effects assessment.	Present condition only is described for the CE VCs; region identified has no previous drivers (aside from fire).	Past and present conditions described for select VCs where data available; attention focused primarily on description of current conditions.	No clear delineation of past from present conditions; focus is on description of current conditions; exceptions include employment and land use.	1975 identified as past benchmark for impact and change assessment, but no CE VC conditions described for that time frame; exception includes qualitative description of past land use and access.
Baseline establishes trends in CE VCs and/or indicator condition change over time	Trends in CE VCs are identified, both quantitatively and qualitatively; from past conditions to present.	No trends or condition changes identified for CE VCs, with the exception of indicators for some socioeconomic VC - but these are not used in the CEA.	There is no CEA in the EIS, and no CE VCs identified for analysis beyond the project's effects assessment.	No trends or condition changes identified.	Previous reference points or conditions reported where data available, but trends in condition change not identified for extrapolation in CEA.	Limited analysis of VC condition / trends over time; exceptions are qualitative descriptions of changes in land use and employment / income data.	Limited analysis of VC condition / trends over time; emphasis on current conditions to benchmark impacts; exceptions are previous caribou surveys and demographic data.
Baseline establishes relationships between CE VCs and/or indicator condition / change and key drivers	Attempts are made for each VC to establish condition change and the responsible drivers.	Emphasis on describing current condition only. Suspected relationships between select socio-economic VCs and drivers of change are qualified (e.g. increased roads, changes in trap line use).	There is no CEA in the EIS, and no CE VCs identified for analysis beyond the project's effects assessment.	Past and present projects identified; relationship to VCs not quantified.	Past and present projects identified, and descriptive relationships to VCs (e.g. disturbed area). Associations to enable trends (spatial or temporal) extrapolation not evident.	Emphasis placed on describing current project, and future impacts.	Suspected relationships between select VCs in CEA and drivers of change (past, present, future) are identified.
CE VC thresholds (e.g. targets, limits, etc.) established in the baseline assessment	Regulatory / guidance thresholds identified for certain VCs (e.g. CCME guidelines, Quebec surface water); other VCs references against baseline as target.	Regulatory / guidance thresholds identified for certain VCs (e.g. CCME guidelines, Quebec surface water); no targets or limits set outside regulatory or policy guidance.	There is no CEA in the EIS, and no CE VCs identified for analysis beyond the project's effects assessment.	Regulatory / guidance thresholds identified for certain VCs (e.g. CCME guidelines, regulations for the quality of drinking water [c. Q-2, r.40]); no targets or limits set outside regulatory or policy guidance.	Refers to Directive 019 for mining industry, CCME and other regulatory guidelines; no targets or limits set outside regulatory or policy guidance.	No thresholds or targets identified for the CE VCs.	Regulatory / guidance thresholds identified for certain VCs (e.g. CCME guidelines, regulations for the quality of drinking water [c. Q-2, r.40]); no targets or limits set outside regulatory or policy guidance.

[6] The analysis is not comprehensive of all VCs identified in the EIS baseline assessment. Analysis of baseline VCs is focused only on those VCs that were identified also in the CEA section or chapter of the EIS.

[7] Green indicates that the review criterion has been satisfied. Yellow indicates that the review criterion has been partially satisfied. Red indicates that the review criterion has not been satisfied.

6.3 Prospective Analysis

Prospective analysis is the analytical phase of CEA. Data and information about VC conditions identified during the assessment, and knowledge and assumptions about the project and other potential future disturbances, are used to predict and evaluate the project's contribution to effects on VCs in combination with the effects caused by other projects, activities and disturbances. Prospective analysis might involve 'summing up' individual effects such that the total effects on VCs are evaluated and summarized into trend information, focusing on regional environmental issues and whether they will grow worse or better, and assessing the effects on VCs of regional change agents such as surface disturbance that are, by definition, cumulative and provide a measure of ecosystem health (Gunn and Noble 2012).

In other instances, however, data may be limited and quantitative trends for extrapolation difficult to establish. Scientific data should thus be supplemented with knowledge from other areas with comparable conditions, from community knowledge, and from Aboriginal traditional knowledge. Quantification is desirable, though not always possible. In all cases, good prospective analysis of cumulative effects is evidence-based, with the rationale for the cumulative effects prediction or anticipated outcome clearly articulated and the assumptions disclosed.

The analytical phase of CEA was weak across the sample of EISs (Table 10). Potential cumulative effects were often identified but neither described nor supported by evidence. There were some exceptions, specifically the Eastmain 1-A project. The Eastmain 1-A CEA used information about trends in VCs and VC conditions established during the baseline analysis to support the prediction and analysis of the project's cumulative effects, including total effects to VCs. For most projects, however, the depth of analysis of cumulative effects, and the supporting evidence to validate the assessment results, was weak.

The CEA practitioner's guide (Hegmann et al. 1999), and current technical guidance for CEA under CEAA 2012 (CEAA 2014), is clear that several approaches are available to support the assessment of cumulative effects, including impact models, spatial analysis, landscape level indicators of change, and numerical modeling. There is no one single approach to always be used, nor necessarily one type of approach for specific effects; however, the types of tools used to support the analysis of cumulative effects must be identified in the EIS and a record of assumptions, data, and confidence in data and analysis is needed in order to justify conclusions and present a defensible analysis of cumulative effects. Professional judgment or assertions appeared to be the primary tool or technique used for the identification of potential cumulative effects in the sample of EISs reviewed.

Several technical tools and analytical methods were used to assess project-specific effects on VCs, and to characterize baseline conditions, but it did not appear that these tools or models were carried forward and used to support cumulative effects analysis. There is nothing inherently wrong with the use of professional judgment in predicting and assessing cumulative effects; however, professional judgment should be clearly distinguished from that based on a specific form of analysis and data – and the assumptions, limitations and degree of confidence in the prediction or statement should be clearly explained. Most all of the section 22 EIS directives included this requirement (see sec. 4.2.3); however, the specific approach to cumulative effects prediction, and the confidence of those predictions and outcomes, was missing for most all cumulative effects statements identified in the sample of EISs reviewed.

We observed limited evidence or analysis of cumulative effects to support many of the observations or cumulative impact statements presented in the EISs. The baseline assessments presented were descriptive in nature, following the guidance as set out in the EIS directives. When trends were identified, or modeled, that information was not carried forward to predict or model potential cumulative effects. The Eastmain 1-A EIS was the only exception. We found little evidence of trends analysis, extrapolation, establishing stress-response associations, or modeling of future VC conditions in the CEA sections or chapters of the other EISs. In most instances, CEA was limited to qualitative description and with limited analytical context to support the observations made.

As a result of limited or missing analysis, many cumulative effects predictions, or anticipated VC future conditions, were qualitative statements, often vague or imprecise, and not supported or substantiated by evidence – either by an explanation as to how the conclusion was reached, or by modeling data or trends to support the conclusion.

For example:

- *Route 167 CEA:* With respect to woodland caribou,"[g]iven the size of the area under study, the existing and proposed linear right-of-way should not, by themselves, jeopardize the Woodland caribou population, but they will probably contribute to higher mortality rates due to increased wolf predation and poaching" (EIS pg. 315). There is no quantification or spatial or temporal characterization of the potential magnitude of the cumulative effect to Woodland caribou relative to a baseline condition, and no confidence limit (quantitative or quantitative) attached to the probability of the cumulative effect occurring.

- *Renard CEA:* With respect to the aquatic environment, "[a]dditional pressure on freshwater resources due to the harvesting of water for projects may contribute to recharge reduction during the intermediate-to-low-flow period" (EIS pg. 10-39). There is no quantification of the potential cumulative effect, no analysis of the magnitude and duration of the effect, and no qualification of the probability of the effect occurring.

- With general reference to cumulative effects predictions: "When trying to assess the cumulative effects of the Renard Project, in conjunction with other past, present and future projects, it is difficult to reach an accurate appraisal as many factors extraneous to the Renard Project itself are at issue here" (EIS p 10-53). This is indeed true, but it is the essence of doing a CEA.

- *Matoush CEA:* The EIS contains a 3 page CEA (EIS, sec 7), with no supporting analysis or evidence.

  With regard to wildlife, "…a cumulative impact could result if human-wildlife interactions become problematic and wildlife may need to be caged and relocated further from site or killed" (pg. 235). There is no qualification of the impact, or of what constitutes a problematic level of interaction or conflict.

  "The combination of these projects could potentially have an increased impact on the vegetation and increase wildlife habitat lost or fragmentation. Yet, the combined effect is likely to be negligible…. These projects are too few and far apart to have a noticeable impact on vegetation or wildlife. In the event that a cumulative impact does arise, it is more likely to relate

to population redistribution rather than a decrease in wildlife population" (Vol. 1, p. 235). No data could be found in the EIS documentation to support these predictions or characterizations.

- *Eleonore CEA:* With regard to surface water quality, "[d]ue to the proximity of the Eastmain 1-A and La Sarcelle power plants and the construction of the Sarcelle Eastmain 1….and Eleonore site power lines, there is a potential for a cumulative effect on the surface water quality of the Opinaca Reservoir mainly from increased turbidity" (pg 10-9). That land clearing adjacent to a water body poses a risk of increased turbidity is intuitive; there is no analysis of the magnitude of the potential cumulative effect or of the likelihood of the potential effect occurring and its duration.

- Regarding cumulative effects to socioeconomic VCs, "All of the projects mentioned and the Éléonore project have the potential to cause cumulative effects on the socio-economic aspects (positive and negative). It will likely be a magnification of some of the impacts described in Chapter 9, but the same mitigation and improvement measures will apply. The best way to increase positive effects and minimize negative effects is to consult the communities beforehand, and make some adjustments when required…" (EIS, sec 10.6.4). The potential for cumulative effects is identified, but the effect is not characterized and there is no supporting evidence.

- *Bachelor CEA:* No analysis of cumulative effects was presented in the EIS. Sec 8.1.3 simply states, with regard to the assessment of the project's impacts, that "The impact's intensity also takes into consideration the cumulative, synergistic or delayed effects which, beyond the simple cause-and-effect relationship, can magnify the disturbance of an element when the environment is especially sensitive." No distinction of cumulative effects or analysis is provided.

The approach for identifying and analyzing cumulative effects often could not be distinguished from the approach used for analyzing the project's effects. Much of the information reported about cumulative effects was based on assertions for which we could not find in the EIS supporting cumulative effects analysis. Qualitative descriptions of cumulative effects are still useful in CEA, but only if supported by defensible analysis.

It is possible that CEA analyses may have been presented elsewhere, in technical reports prepared to support the EIS; however, there was no such analysis presented in the CEA chapters or sections of the EISs or refer to such reports.

Table 10. Prospective analysis of cumulative effects in the sample of EISs[8]

Review criteria	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Mine
CE predictions, scenarios or conditions are identified for affected VCs or indicators	Yes, and with potential condition change often quantified for each VC or indicator.	Yes, but predictions are qualitative and lack magnitude or quantification of change.	No section or chapter of the EIS dedicated to CEs.	Yes, but neither quantified nor clearly supported by analytical context or other evidence.	Future VC conditions summarized across spatial / temporal scales, but no analytical support.	Yes, future VC conditions are described / qualified.	Yes, qualified statements for most VCs of interactions with different projects and activities.
Trends and linkages in baseline analysis used to inform future conditions or predictions	Yes, trends and associations are used to inform CE predictions for most VCs and indicators.	No. Baseline data or trends are not used in the CE predictions.	No section or chapter of the EIS dedicated to CEs.	No in-depth analysis or use of trends or baseline change to predict or understand CEs.	No. VC interactions with the project are identified, but no trends identified to connect VCs to CEs.	No evidence of trends, baseline analysis or other relationships used to inform predictions.	No evidence of baseline trends to support CE predictions; largely qualitative assertions.
Tools and techniques used are appropriate to capture / assess CEs and the uncertainties of future conditions	Supporting tools are identified for different VCs, including prediction models where relevant.	Professional analysis and field data used in baseline, but no tools identified to support CEA.	No section or chapter of the EIS dedicated to CEs.	No supporting tools or techniques identified for CE predictions or futures.	Reference made to data collection tools and approaches for baseline, but no tools identified for CE predictions.	No specific tools identified for CE analysis; supporting tools are identified for characterizing VCs in baseline.	Tools identified in project-specific VC assessment, but no tools identified for CE predictions.
Sufficient analysis / evidence is provided to support statements or conclusions about CEs	Impacts are supported by empirical evidence, typically quantifiable, and with reference to baseline trends or conditions.	VC analysis for CE is vague, with no supporting evidence or data.	No section or chapter of the EIS dedicated to CEs.	Primarily expert-based evaluation, with limited supporting data. No reference to baseline conditions as evidence.	Professional judgment and mostly qualitative statements. Some analysis for past and current, but predictions largely unsupported.	Experiences or lessons from elsewhere, but limited evidence or analysis to support CE conclusions.	Judgment or assertions. Based on accumulated state; no models, trends, or comparisons to similar projects.
CE predictions / assessment focuses on total effects on the VCs and the project's incremental contribution	Total effects on VCs are described and the project's incremental effects - often quantified.	No, total effects are not assessed / considered.	No section or chapter of the EIS dedicated to CEs.	Insufficient analysis provided in the EIS to determine total effects or project's contribution.	Qualitative summary of total effects to VCs, but no quantification of project's incremental impact.	Descriptions of individual project effects to VCs, but not total effects or CEs.	Total impacts on VCs synthesized across time and space. Incremental project contributions not clearly measured.

[8] Green indicates that the review criterion has been satisfied. Yellow indicates that the review criterion has been partially satisfied. Red indicates that the review criterion has not been satisfied.

6.4 Cumulative Effects Significance and Management

The management phase of CEA involves the identification of potentially significant cumulative effects, identifying impact management measures for those effects, and developing follow-up and cumulative effects monitoring programs. This first requires an evaluation of the total effects on VCs, including the effects of the project plus the effects caused by other sources, and some assessment against significance thresholds, management targets, or maximum allowable limits of change identified during the retrospective or scoping stages of the assessment to determine how much cumulative change in the VC is deemed acceptable. Viable management measures are then proposed, considering the range of possible future outcomes or VC conditions.

Our analysis indicates that the significance of cumulative effects, along with mitigation and monitoring needs, received limited attention across the sample of EISs (Table 11). This may be attributed to the EISs identifying few residual impacts that would result in significance adverse cumulative effects. However, for those cumulative effects that were assessed, practice was variable.

The sample of EISs was weak in terms of establishing benchmarks or reference conditions against which to assess the significance of cumulative effects, and weak in the use of explicit limits or thresholds for significance determinations. The Eastmain 1-A CEA identified a baseline or reference year, and VC conditions, against which most effects were assessed. For the remaining EISs, however, the significance of cumulative effects was either not addressed (Bachelor, Matoush), focused only on select VCs (e.g. water quality – Eleonore), focused on cumulative disturbance, but with no reference condition (e.g. Route 167), or described reference conditions qualitatively such that changes from baseline or the benchmark due to cumulative effects were not measurable.

In the case of the Renard project, a particularly poor practice was adopted for assessing the significance of the project's cumulative effects to land use, particularly trap lines. The project's cumulative effects were traded off against the magnitude of the effects of other projects, as opposed to assessing the cumulative effect to the VC of concern. For example, with regard to land use by the Crees, the effects of the Renard project were assessed to be: "…very limited if compared to the impacts of the La Grande Hydroelectric Complex (approximately 40 traplines affected), the Eastmain-1-A-Sarcelle-Rupert Hydroelectric Project (36 traplines) and the James Bay access roads." This is poor practice in CEA (Gunn and Noble 2012; Duinker and Greig 2006).

Aside from water quality (CCME guidelines), and other VCs with regulatory guidance (e.g. noise), there was limited evidence of the use of significance thresholds for assessing the significance of cumulative effects. The section 22 EIS directives for the Bachelor Lake, Matoush, Renard and Whabouchi projects all directed the proponent to establish such acceptability thresholds or limits for understanding the intensity and significance of effects, but most thresholds or limits identified in the EISs were not used in the assessment of cumulative effects. The Matoush directive specifically directs the proponent to establish thresholds or levels of acceptability when assessing cumulative effects (EIS Directive, sec. 3.5), but the Matoush CEA makes no reference to thresholds or limits for cumulative effects determinations.

The focus of CEA was typically on the project's stress, and in some cases its cumulative disturbance or incremental impact, but with insufficient attention to assessing the significance of cumulative effects based on the health or condition (e.g. functioning, sustainability) of the VC.

As reported earlier, only one section 22 directive contained a specific requirement for the mitigation and monitoring / follow-up of potential cumulative effects. We were not surprised then to find that mitigation, including follow-up and monitoring, were not addressed for most cumulative effects identified across the sample of EISs. Exceptions were Eastmain 1-A, which identified mitigation and monitoring measures to address cumulative effects, and the Eleonore project, which identified mitigation and monitoring measures for cumulative effects concerning surface water quality, fish and fish habitat and socioeconomic impacts.

This is not to suggest, however, that cumulative effects were not accounted for in some way in the project's mitigation and follow-up programs. In most cases, the VCs identified in the CEA were also identified in the project-specific mitigation and monitoring programs. For example, in the Matoush EIS an environmental monitoring program is prescribed for several VCs, including air quality, surface water quality, and benthos and worker health. That said, these programs were not specific to cumulative effects matters and relate mostly to monitoring project stress.

Cumulative effects require cumulative solutions (Creasey and Ross 2005). Both the Renard and Matoush EIS make specific reference to the need for a collaborative approach to the management of certain impacts (e.g. archaeological and cultural resources, biodiversity) (pg. 10-56); however, no details are provided as to the nature of such an approach or who will be responsible for mitigation and management efforts.

Table 11. Cumulative effects significance, monitoring and follow-up of cumulative effects in the sample of EISs[9]

Review criteria	Eastmain 1-A	Eleonore Gold Mine	Bachelor Lake Gold Mine	Matoush Uranium Exploration	Renard Diamond Mine	Extension of Route 167 N	Whabouchi Mine
CEs / change assessed against benchmarks or a reference condition for the affected VC	Yes, the baseline year of 1975 is identified as the benchmark for most VCs.	No. Only VC with a past or reference condition identified is water quality.	No section or chapter of the EIS dedicated to CEs.	The significance of CEs is not addressed.	Yes, for many VCs (e.g. terrestrial, wetland, aquatic).	Project's CE / additional stress identified, but not assessed against reference condition.	No reference conditions established for CEA; VC conditions described qualitatively.
Thresholds, limits or regulatory targets used to assess CE significance	Determinations based on professional judgment and change from baseline.	No. Only VC with a CE limit or threshold identified is water quality.	No section or chapter of the EIS dedicated to CEs.	The significance of CEs is not addressed.	Directive 019 for mining industry; regulations for the quality of drinking water (c. Q-2, r.40); CCME guidelines - unclear if used for significance.	Limits based primarily on public / professional concern of project's impact to VCs.	Regulatory limits for noise, but not included in CEA; other limits based on judgment.
Incremental CE contributions of the project are clearly identified	Yes. CE attributable to project actions identified for most VCs included in CEA.	No. Focus is on follow-up or justifying no impact vs. assessing CEs.	No section or chapter of the EIS dedicated to CEs.	Project impacts to baseline considered in EIS, but not addressed for CEs.	Yes. CEs considered in addition to impacts from other activities.	Focus on incremental stress vs. incremental effect.	Qualitatively described but with no clear measurement of incremental effect.
Significance of CE is based on VC health or condition (vs. magnitude of the project's impact)	Based primarily on project's contribution, benchmarked against the 1975 La Grande construction baseline.	No. But reference is made to the need for monitoring to ensure health of fish populations.	No section or chapter of the EIS dedicated to CEs.	Health/condition was considered for some VCs (e.g. sediment), but this information was not included in CE determination.	Typically based on the magnitude of the project's incremental impact (vs VC health or condition).	Based on the magnitude of the project's impact, and total cumulative disturbance (vs. VC health or condition).	Focus largely on stress or cumulative pressure on VC, vs the CE or VC condition / status.
Mitigation measures are identified for CEs	Yes, for each VC subject to CEA.	Yes, specifically surface water quality, fish and fish habitat, and socioeconomics.	Mitigation identified for project impacts. No mention of CEs.	Mitigation for CEs was not addressed.	No mitigation plans that speak directly to CEs, aside from an impact benefit agreement.	Mitigation measures identified for project effects but not specific to CEs.	No, with the exception of a reference to socioeconomic mitigation plans.
Adaptive management measures are identified for CEs that are uncertain	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs.	No mention of adaptive management measures for CEs. Reference to an environmental management system, but not for CEs.
Monitoring or follow-up measures are identified for CEs	Yes, for each VC subject to CEA.	Yes, specifically surface water quality, fish and fish habitat, and socioeconomics.	Monitoring identified for project impacts. No mention of CE monitoring.	No monitoring programs proposed specific to the CEs identified.	Yes. Need for collaborative approach identified, but no specifics provided.	Monitoring identified for project impacts. No mention of CE monitoring.	Most VCs identified in the CEA are revisited in monitoring and follow-up programs.

[9] Green indicates that the review criterion has been satisfied. Yellow indicates that the review criterion has been partially satisfied. Red indicates that the review criterion has not been satisfied.

7. CONSIDERATION OF CUMULATIVE EFFECTS IN EA AUTHORIZATIONS AND CONDITIONS

All post-EIS authorizations contained requirements for monitoring and follow-up of effects or concerns identified in the EIS and/or in the review committee or panel reports. However, there were few conditions that related directly or indirectly to addressing or managing the project's potential cumulative effects. The majority of post-EIS authorizations regarding monitoring and follow-up focused on verifying the effectiveness of a mitigation measure or implementing monitoring to ensure that the project's stress (e.g. effluent discharge rate / concentration) is within a specified limit (project-focus), versus also monitoring baseline or ambient conditions of the receiving VC (cumulative effects-focused).

Only one post-EIS authorization contained a condition specifically addressing cumulative effects that was tied directly to the responsibility of the project proponent – a requirement for cumulative effects monitoring. This condition was found in the Whabouchi post-EIS authorization – the most recent project in the sample.

The earliest project in the sample (Eastmain 1-A) was the only post-EIS authorization to recognize the importance of a regional approach to understanding and managing cumulative effects. The Eastmain 1-A federal review and Quebec review committee reports identify potential cumulative effects of concern emerging from the project. The Quebec post-EIS authorization indicates that the responsibility for assessing and managing cumulative effects in the region was beyond the responsibility of the proponent, and recommends a future cumulative effects monitoring and follow-up program; however, there were no project-specific conditions regarding cumulative effects to address those issues and concerns attributed directly to the project.

Below we report key findings, project-by-project, from our review of the post-EIS authorizations and conditions.

7.1 Eastmain 1-A

Both the federal panel report and COMEX report speak specifically to concerns about the project's cumulative effects. The federal panel questioned the proponent's selection of VCs and indicators used in its CEA, noting that the narrow view adopted for some VCs and indicators, such as mercury, was insufficient for understanding cumulative effects – such as cumulative effects to the health and wellbeing of the Cree communities. The federal panel, for example, notes: "It feels that the cumulative impact is real, but difficult to quantify, making it impossible to specify the relative significance of the incremental cumulative impact and the causes of change attributable to the project (pg. xxi)." The panel report also notes the narrow extent of the CEA regarding the Cree communities examined, and suggested that a study of other potentially affected communities is needed. The panel report then goes on to state that "because the effects extend beyond the borders of the province and affect many jurisdictions…a formal analysis of these impacts cannot be conducted without establishing a large-scale research and follow-up program, a measure which the Panel recommends" (pg. xxii). The federal decision document / project authorization, however, makes no mention of cumulative effects – either to address the project-based CEA deficiencies identified by the panel, or to address the need for a broader regional follow-up program to address cumulative effects.

COMEX also speaks to the adverse cumulative effects of the project, noting, for example, that "the cumulative effects of the project being studied will complement an already large and complex 'baggage', and this in a territory that has experienced rapid and intense development over the past 30 years" (pg.

407). Several conditions are included in the provincial authorization that speak to the need for follow-up programs for monitoring baseline conditions, and verifying the effectiveness of proposed impact mitigation measures. However, any conditions regarding cumulative effects are deferred to a future assessment or study. Under condition 8.1, for example, the Provincial Administrator notes that "The evaluation of the cumulative impacts of the hydroelectric projects of James Bay and Hudson Bay, by reason of their scope, concerns several jurisdictions and goes beyond the responsibility of one single proponent. The analysis of these impacts cannot be done without setting up a large scale research and follow-up program carried out by a consortium…responsible for this issue which, devolves only partially on the proponent…" The COMEX report goes on to note that the cumulative effects of this latest project can only be determined through a wide-scale and long-term follow-up of social impacts on Cree society, and "…a single proponent should not be responsible for these cumulative impacts, and that their analysis should be the responsibility of all the jurisdictions involved" (pg. 416).

Such conditions are useful when they are followed-through and when the data collected and knowledge generated are actually used to inform future developments in the region. Such conditions do little to effectively assess the potential cumulative effects of the project under consideration; rather, the burden of proof of cumulative effects is transferred to the future.

7.2 Eleonore

There are no conditions contained in the provincial certificate of authorization that speak specifically to cumulative effects. Conditions largely focus on follow-up and monitoring to verify mitigation or to ensure that project stress or contaminants are within an acceptable or stated level. Condition 5.1 does refer to monitoring water quality and status of fish populations (VC-based condition monitoring), but does so specifically with regard to detecting the effects of tailings.

7.3 Bachelor Mine

There are no conditions that speak specifically to cumulative effects. Conditions largely focus on follow-up and monitoring to verify mitigation or to ensure that project stress or contaminants are within an acceptable or stated level. For example, the modified certificate of authorization condition # 8 focuses on ensuring compliance with environmental discharge objectives, and condition # 11 emphasizes "…analysis of exceedances and changes in the quality of the discharge into the host environment over the years." There are no requirements for cumulative effects or effects-based monitoring.

7.4 Matoush

The federal review panel report raises concerns that the proponent's CEA was "fairly basic, is short on details regarding the impacts of other projects examined as part of the assessment, and contains some fairly questionable comparisons…" (sec. 9.2.3). The panel specifically raises concerns about the lack of consideration of other past and future mining projects in the region, noting that the "proponent did not seem to consider the impacts of these projects or, at the very least, did not seem to have made any effort in this regard". Interestingly, and notwithstanding criticisms of the limited evidence presented in the proponent's EIS, the panel goes on to conclude that the project is not likely to cause significant cumulative effects, and there are no subsequent conditions in the federal authorization/ decision statements that address cumulative effects. The COMEX report for the Matoush project does not speak to the project's cumulative effects or to the quality of the CEA. The province did not issue an authorization for the project.

7.5 Renard

There are no conditions that speak specifically to cumulative effects. The federal comprehensive study report concludes that the project is unlikely to cause significant cumulative effects due to the proponent's mitigation, the distance separating projects in the region, and the relative footprint of development in comparison to the size of the geographic region. Conditions largely focus on developing improved baseline understanding and evaluating the effectiveness of proposed impact mitigation measures. Most conditions focus on monitoring project stress and, in particular, mitigation measures to reduce project stress. However, ambient or baseline monitoring conditions are specified for certain parameters, including groundwater quality, status of fish populations, phosphorous concentrations, and monitoring of land use, which may be valuable for developing baselines for future assessments to aid in cumulative effects understanding.

7.6 Route 167N

The federal comprehensive study report does raise some concern about potential cumulative effects. Specifically, it's noted that the road project will increase anthropogenic disturbances in the study area, accounting for more than half of the disturbed area, indicating that the status of the study area will come close to the critical threshold at which a local caribou population could become non self-sufficient. There are no conditions in either the federal decision statement or provincial certificate of authorization that speak specifically to cumulative effects mitigation or follow-up. All conditions issued focus on follow-up and monitoring to verify mitigation or to ensure project stress or contaminants are within an acceptable or stated level.

7.7 Whabouchi

This is the only project with a specific condition regarding cumulative effects related to the project being assessed. Condition # 26 of the provincial authorization is the one condition that refers to the project's cumulative effects, requiring that "the proponent must incorporate the monitoring of cumulative effects proposed in its Environmental and Social Impact Assessment into the environmental and social monitoring program…".

The majority of the remaining conditions speak to specific project-induced stress, such as monitoring to ensure that average monthly concentrations of phosphorous in the project's effluent are within a certain, specified level (condition # 32). Such stress or emissions-based conditions are valuable for mitigating the project's contributions to cumulative effects, but they do not assist in understanding total effects to the VC of concern. There are, however, other conditions that do speak to ambient or baseline monitoring, and not to the project's specific actions per se – for example, condition # 36 specifies that the proponent monitor the integrity of walleye spawning ground in Lac des Montagnes, and that monitoring must enable validation of continuous walleye spawning and recruitment conditions.

9. CONCLUSION

This report presented an analysis of the application of CEA in the context of Section 22 project EAs conducted in the James Bay Territory. The focus of the analysis was on a sample of seven EISs, including their respective federal and Quebec provincial directives and decision documents, issued between 2002 and 2015. The analysis was guided by a set of good-practice CEA review criteria developed by Aura, tested in previous CEA reviews, and approved by the JBACE. Several observations emerged from the analysis concerning the practice of CEA in the James Bay Territory:

A. *The instructions and guidance provided to project proponents are often insufficient to facilitate good-practice CEA and to support longer-term understanding and management of cumulative effects to VCs of concern.*

   The quality of CEA conducted by the proponent was often a reflection of nature and scope of the project-specific directives for carrying out the EAs. All seven of the section 22 EA directives made explicit reference to cumulative effects, but there was inconsistency with regard to a basic CEA principle: only four of the directives instructed the proponent to focus on past, present *and* future considerations. The section 22 directives were relatively consistent in instructing the proponent to identify assessment boundaries based on the distribution or features of the VCs or land uses of concern (an important principle of good-practice CEA scoping), and in providing guidance on a minimum set of biophysical and socioeconomic VCs for consideration in the CEAs; however, cumulative effects monitoring requirements for those VCs were typically absent.

   A limitation observed across all but one directive was the focus on requiring the proponent to describe current conditions in their baseline assessment but not also identify past conditions and establish changes or trends in VC conditions over time to assist in CEA analysis and predictions. Proponents were consistently instructed to justify and explain the methods used in their EAs, but the directives stopped short of providing guidance and general principles on *how* the proponent should carry out the CEA. Federal directives generally provided more guidance on how to approach CEA, grounded in the Canadian Environmental Assessment Agency's Operational Policy Statement and practitioner guidance; however, federal directives (with the exception of the Eastmain 1-A) were more restrictive in the scope of assessment – particularly the range of VCs to be considered and the inclusion of socioeconomic VCs.

B. *There is considerable variability in how cumulative effects are addressed in project EISs, but overall cumulative effects receive insufficient attention, appear to be subjected to limited analysis, and the CEAs often lack evidence to support the conclusions made about cumulative effects.*

   The EISs tended to perform strongest in terms of scoping practices, specifically the inclusion of *both* physical/ecological and socioeconomic VCs; the consideration of past, existing and future disturbances as part of the CEA; and defining CEA boundaries based on the distribution of the VCs potentially affected. The EISs also performed strongly with regard to *describing* present (and typically past) conditions of VCs in the project's area; however, there was limited analysis of trends in VCs and / or indicator change over time or space to assist in the analysis and projection of cumulative effects. All but two of the EISs *did* identify thresholds or limits to assist in CEA significance determinations; though, thresholds or limits were typically those defined in regulatory guidance (e.g. directives, water quality guidelines, industry regulations) and not comprehensive of the range of VCs and indicators considered in the EIS.

The most significant shortcomings concern the analysis / assessment of cumulative effects and commitments to cumulative effects follow-up and monitoring. Overall, cumulative effects were subject to limited analysis in the EIS. In only a few instances was there sound evidence (e.g. models, data, trends) provided to support the EIS's conclusions about cumulative effects, when such effects were considered. Many cumulative effects predictions, or anticipated VC future conditions, were qualitative statements, often vague or imprecise, and not clearly supported or substantiated. Finally, mitigation, including follow-up and monitoring, were not addressed for most cumulative effects identified across the sample of EISs. This was not surprising, as only one section 22 directive contained a specific requirement for the mitigation and monitoring / follow-up of cumulative effects.

There were some exceptions to the above deficiencies, specifically the Eastmain 1-A project, which reflected better practice than the more recent assessments. This may be attributed, in part, to the history of Hydro Quebec operating in the region, the availability of supporting data and project development plans within the hydroelectric sector, the preparation of the EIS under a joint directive (and accompanying guidance) between the Evaluating Committee (COMEV) and the Canadian Environmental Assessment Agency, and the integration of public concerns in the EIS directive.

C. *Although the consideration of cumulative effects was required in all of the EISs, and notwithstanding the state of practice and concerns identified in the review committee or panel reports, there were few conditions placed on the project's approval that related to managing or monitoring the project's cumulative effects.*

The directives all included a requirement for the consideration of cumulative effects, but with minimal instruction; the proponent provided a weak assessment of cumulative effects in their EISs; the review committees or panel reports often raised serious concerns about cumulative effects; then, the decision document or determination, including approval conditions, made no reference to cumulative effects.

All post-EIS authorizations contained requirements for impact mitigation, monitoring and follow-up; however, there were few conditions that related directly or indirectly to managing or monitoring potential cumulative effects. The majority of post-EIS authorizations focused on verifying the effectiveness of mitigation or monitoring for compliance, versus also monitoring baseline or ambient VC conditions to identify cumulative effects. Only one post-EIS authorization (Whabouchi) contained a condition specifically addressing the project's cumulative effects; and the Eastmain 1-A was the only post-EIS authorization to explicitly recognize the importance of a regional approach to cumulative effects management – though, no specific direction was provided for a regional cumulative effects monitoring or management program.

In conclusion, there is a strong rationale for the development of regional cumulative effects frameworks, under the umbrella of regional or strategic EAs. Such frameworks can stretch current institutional boundaries, but they are essential to assessing and managing cumulative environmental change. At the same time, however, the individual efforts of agencies and project proponents to assess and to manage the cumulative effects of their own projects remains an important component of the cumulative effects challenge. Although the results presented in this report may not be representative of *all* EA practices in the James Bay Territory, they do suggest considerable room for improvement in the current state of CEA.

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